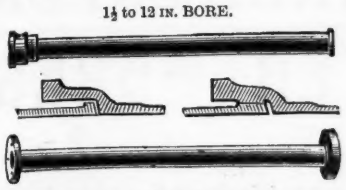
THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXVI. No. 1678.] LONDON, JULY 9, 1895. [47TH YEAR. PRICE 6d.

GAS AND WATER PIPES

1½ to 12 IN. BORE.



THOMAS ALLAN & SONS,

Bonlea Foundry,

SOUTH STOCKTON-ON-TEES.

Formerly Springbank Iron Works, Glasgow.

ESTABLISHED 1848.

ALSO MANUFACTURERS OF

SANITARY & RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES, STOVES, And GENERAL CASTINGS.

Telegrams: "BONLEA, STOCKTON-ON-TEES."

Lanemark Coal Co.,

LIMITED.

LANEMARK CANNEL AND GAS COALS.

Quotations and Analysis on Application to

LANEMARK COLLIERY,

NEW CUMNOCK, N.B.

Shipping Ports: All the principal Scotch Ports.

— ESTABLISHED 1830. —

PARKER & LESTER,

Manufacturers & Contractors.

THE ONLY MAKERS OF

PATENT ANTIMONY PAINT,

Parker's Imperial Black Varnish,

Oxide Paints, Oils, and General Stores for Gas and Water Works.

WORKS:

ORMSIDE STREET, OLD KENT ROAD, LONDON.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

"THE STIDDGREEN."

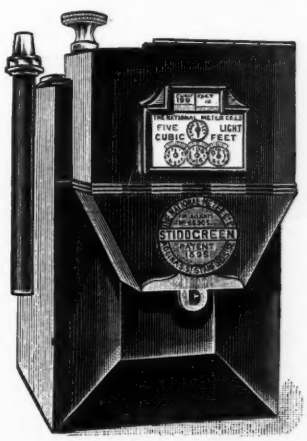
Absolutely the Best Slot-Meter Obtainable.

Guaranteed for 5 Years.

Telegraphic Address: "Stidder, London."

The Silver Coin Meter takes **SHILLINGS AND SIXPENCES,** and the Bronze Coin Meter takes **PENNIES AND HALFPENNIES** in the same Slot, and supplies proportionate quantities of Gas.

Prepayment Indicator marked in single foot spaces; consequently errors of adjustment are visible upon the insertion of the first Coin, and may be instantly corrected.



Telephone Number, 4843.

Price changing to any fraction of a foot *in situ*—no change wheels.

No increase in height or breadth of Meter. Mechanism extremely simple.

Is compact and handsome; cannot be tampered with by any amount of ingenuity; whilst its mechanism is the simplest and strongest in the market.

WE INVITE YOU TO TEST THIS METER.

THE NATIONAL METER CO., LTD.,

Office and Works: **AQUINAS ST., STAMFORD ST., LONDON, S.E.**

SOLE CONSIGNEES:

HENRY GREENE & SONS, 155, CANNON ST., E.C.

CASH PREPAYMENT METERS.

THE "POSITIVE" PREPAYMENT SLOT METER.

Noted for Strength and Simplicity of Construction.

Used by many Corporations and Gas Companies.

Material and Workmanship of the best.

Prices and full Particulars on application.

SAWER & PURVES, MANCHESTER.

PUMPS FOR GAS & WATER WORKS.

FIRST AWARDS EVERYWHERE.

TELEGRAMS: "EVANS WOLVERHAMPTON."

TRADE MARK.

APPLY FOR CATALOGUE NO. 8.

(No Trappets.)

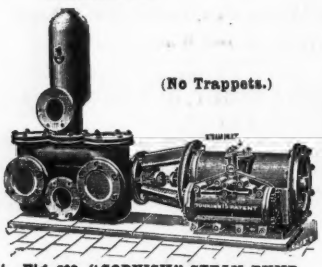


Fig. 600. "CORNISH" STEAM-PUMP FOR WATER.

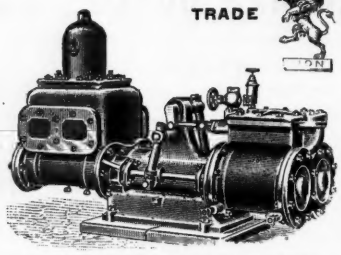


Fig. 670. DUPLEX PUMP FOR GENERAL PURPOSES.

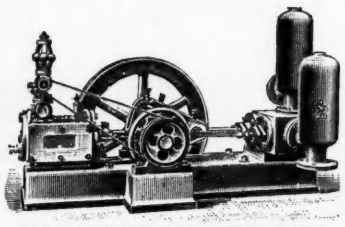


Fig. 685. "RELIABLE" PUMP FOR TAR AND THICK FLUIDS.

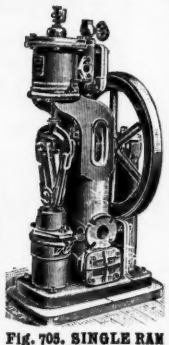


Fig. 705. SINGLE RAM PUMP FOR BOILER FEEDING, &c.

JOSEPH EVANS & SONS, Hydraulic Engineers,

WOLVERHAMPTON. LONDON OFFICE: 16, Union Court, Old Broad Street, E.C.

OUTDOOR LANTERNS

OF EVERY KIND

FOR

GAS

OR

PETROLEUM.

The "BRILLIANT."

APPLY FOR SPECIAL CATALOGUE

(TO THE TRADE ONLY).

Manufactured by

The "IMPROVED CLARENCE."

FALK, STADELMANN, & CO., LTD.,

VERITAS LAMP WORKS,

83-87, FARRINGDON ROAD, LONDON, E.C.

THE BARROWFIELD IRON-WORKS, LIMITED,

Late LAIDLAW, SONS, & CAINE, Limited,

GAS ENGINEERS AND CONTRACTORS,

Telegrams: "GASOMETER GLASGOW."

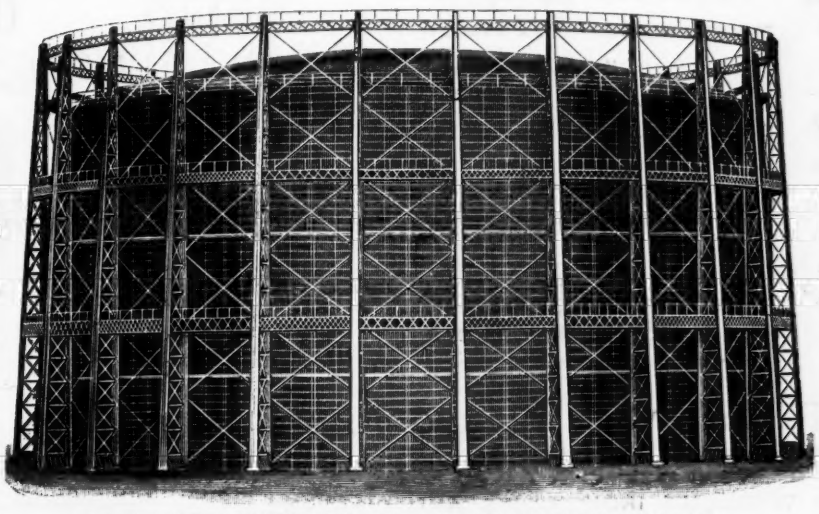
GLASGOW.

GAS APPARATUS OF EVERY DESCRIPTION.

RETORTS, CONDENSERS, SCRUBBERS, PURIFIERS.

GASHOLDERS AND TANKS.

ENGINES, EXHAUSTERS, STEAM BOILERS AND FITTINGS.



OIL PLANT AND CHEMICAL APPARATUS.

BRIDGES, GIRDERS, WHARVES, PIERS.

ROOFING OF EVERY STYLE.

PIPES, VALVES, AND CONNECTIONS.

THREE-LIFT GASHOLDER. Capacity, SIX MILLION cubic feet.
240 feet Diameter by 45 feet Deep each Lift. Erected at Glasgow, 1893.

London Office: 6, LITTLE BUSH LANE, CANNON STREET.

W. H. ALLEN & CO.,

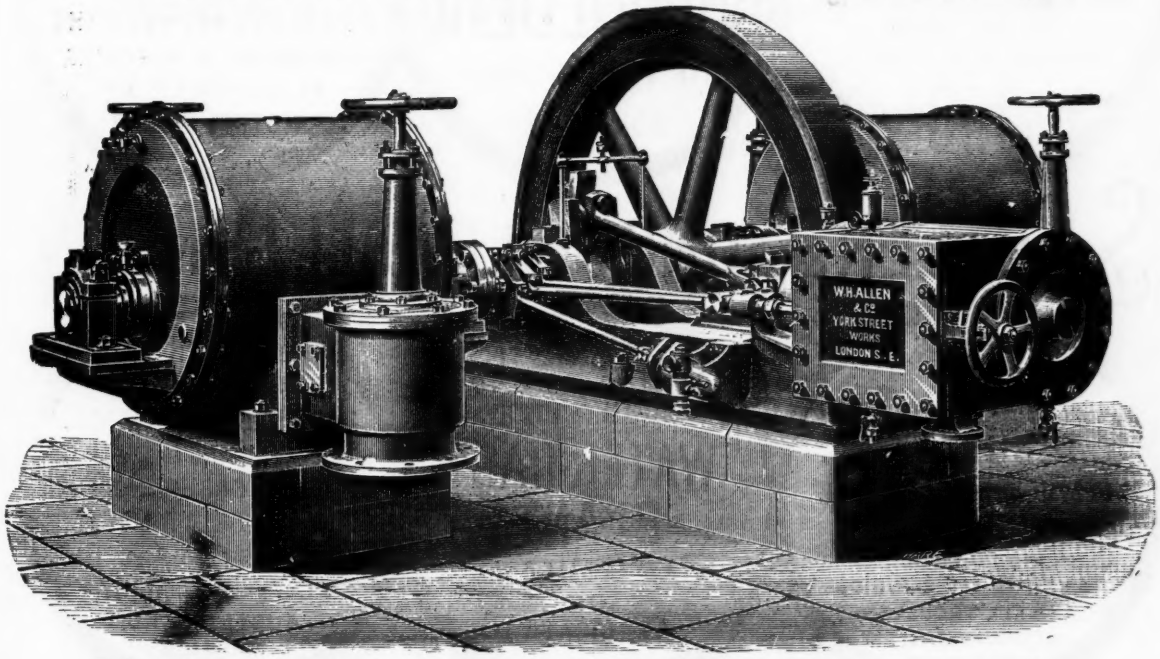
YORK STREET WORKS, LAMBETH, LONDON, S.E.,

And of QUEEN'S ENGINEERING WORKS, BEDFORD,

MAKERS OF THE MOST IMPROVED FORM OF

GAS EXHAUSTING MACHINERY

BEALE'S PATENT—ALLEN'S COMBINED SYSTEM.



Pair of Non-Oscillating Exhausters, passing 200,000 Cubic Feet of Gas per Hour.

GAS COAL.

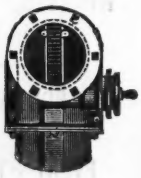
BEST
REAL OLD SILKSTONE GAS COAL,
Address THE STRAFFORD COLLIERIES COMPANY,
Near BARNSLEY, SOUTH YORKSHIRE.

NEWTON, CHAMBERS, & CO., LIMITED,

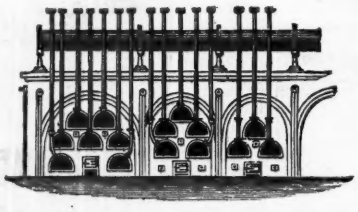
THORNCLIFFE IRON-WORKS, near SHEFFIELD,

MANUFACTURERS OF

SLIDE VALVES,
WITH RACK & PINION
OR
Internal or External
SCREWS of all sizes.
GASHOLDERS,
AND
Gasholder Tanks.



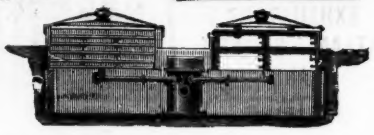
CAST-IRON RETORTS,
RETORT-BED FITTINGS,
And Retort-House Appliances
of every description,
Iron Roofs, Columns, Girders, Floor Plates
and Tools, &c.



WROUGHT AND CAST IRON
CONDENSERS,
SCRUBBERS, & WASHERS,
TAR AND LIQUOR PUMPS, &c.

PATENT
CENTRE-VALVES
for working Purifiers,
Also Bye-Pass & Stop Valves.

PURIFIERS with Planed Joints,
HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS and SPECIALS.
WOOD GRIDS.
CAST AND WROUGHT IRON TANKS AND CISTERNS.



DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

TANKS ROOFS

CUTLERS
PATENT TUBULAR
GAS CONDENSER
SUITABLE FOR GASWORKS
OF ALL SIZES,
AND FOR ANY CLIMATE
OVER 100 ERECTED

MAKERS
OF
GASHOLDERS
OF EVERY SIZE
AND TYPE

HUNT'S
PATENT
WASHER.
IS THE ONLY APPARATUS
NECESSARY BETWEEN THE
CONDENSER & PURIFIERS,
IT REQUIRES NO
MOTIVE POWER

TELEGRAMS
RETORTUS
LONDON

NATIONAL
TELEPHONE
5059.

S. CUTLER & SONS, MILLWALL LONDON

FOREIGN AGENTS

AGENTS
FOR
THE "MAXIM"
CARBURETTER,
A MOST SUCCESSFUL
ENRICHER,
BY WHICH THE USE OF
CANNEL COAL IS AVOIDED
AND ALL TROUBLES
WITH NAPHTHALENE
OBVIATED

IMPROVED SYSTEM OF
CARBURETTED
WATER-GAS
PLANT
PARTICULARS
ON
APPLICATION.

COLONIAL AGENTS

CUTLER'S
FREEZING PREVENTER
IS THE BEST APPLIANCE,
FOR PREVENTING FORMATION
OF ICE IN GASHOLDER CUPS.
IT IS IN USE AT MANY
IMPORTANT WORKS IN
ENGLAND, GERMANY,
AUSTRIA, AND
AMERICA.

ELECTRIC FITTINGS

DYNAMOS MOTORS.

WILLEY & CO.

GAS ENGINEERS & CONTRACTORS,

Central Works: Commercial Road, **EXETER**;

Meter Works: James Street, **EXETER.**

Telegraphic Address: "WILLEY, EXETER." Telephone No. 132.

Edison-Bell Phonograph Used.

Metropolitan Agent: CAPTAIN ACLAND, M.Inst.M.E., Assoc.M.Inst.C.E., DOCK HOUSE, BILLITER STREET, LONDON.

Manufacturers of every Requisite for Gas-Works.

Specialities: GASHOLDERS, GAS-METERS, GAS-FITTINGS.

WILLEY AND CO. beg to announce that they have recently acquired the Sole Right and Proprietorship of the

"SIMPSON"

Automatic Penny-in-the-Slot Meter

(By Royal Letters Patent),

An application of the "Vernier Principle," ensuring Mathematical Accuracy of Registration, combining all the latest Scientific Improvements

PRICE INSTANTLY, SIMPLY, & READILY ADJUSTED *IN SITU*, BY SINGLE FEET OR HALF FEET, WITHOUT CHANGE OF WHEELS.

STRENGTH, DURABILITY, & MINIMUM SIZE.

AMPLE WARNING & GRADUAL EXTINCTION.

BASE OR MISTAKEN COIN DETECTED & RETURNED.

Terms on Application.

NEW CATALOGUE OF GAS-FITTINGS of novel and registered designs, with Special Quotations to Gas Companies, now in the Press for early circulation.

Agents for the "MAXIM PATENT CARBURETTOR" New Process of Gas Enrichment by Carburine.

Telegraphic: "Fortress, Donnington, Salop."

C. & W. WALKER,

Telegraphic: "Fortress, London."

MIDLAND IRON-WORKS, DONNINGTON, NEAR NEWPORT, SHROPSHIRE.

London Office: 10, FINSBURY SQUARE.

PURIFIERS with Planed Joints.

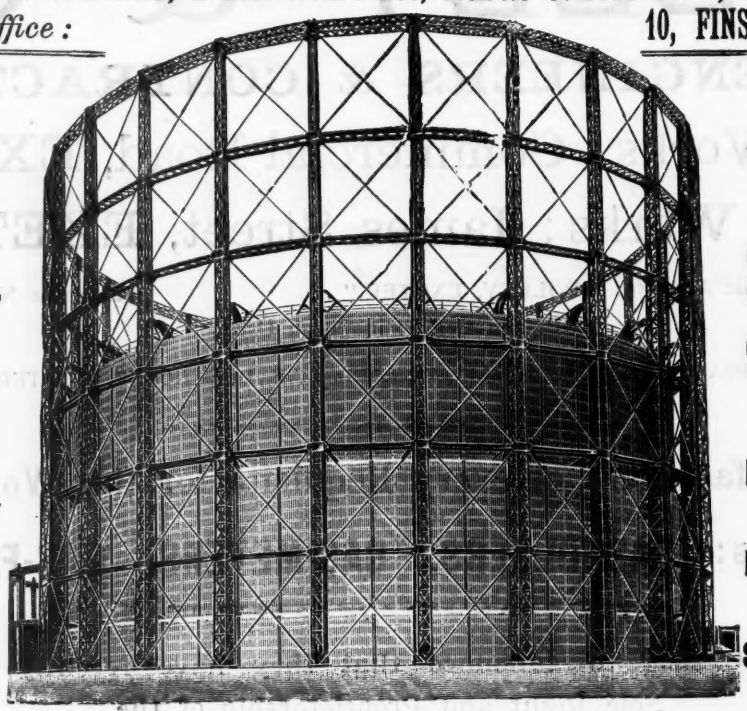
TOWER SCRUBBERS.

WECK'S PATENT CENTRE-VALVE.

CONDENSERS.

TAR PLANT.

SULPHATE OF AMMONIA PLANT.



Eight Million Cubic Feet Gasholder at Beckton, London.

WASHERS.

WASHER-SCRUBBERS.

CLAUS' SULPHUR-RECOVERY PLANT.

CENTRE & FOUR-WAY VALVES.

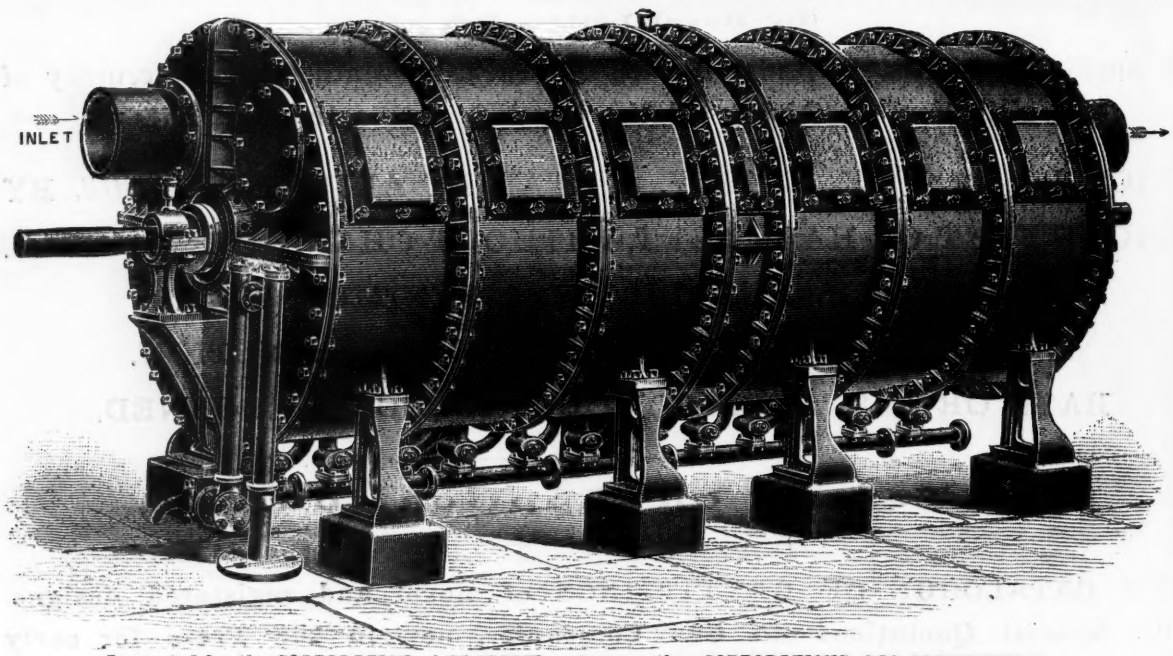
CRIPPS' HYDRAULIC MAIN VALVE.

RETORT-MOUTHPIECES.

SLIDE-VALVES, TAR-BURNERS, SIEVES.

WALKER'S PATENT PURIFYING-MACHINE.

W. C. HOLMES & CO.'S PATENT ROTARY SCRUBBER-WASHER



As erected for the CORPORATION of GLASGOW, and many other CORPORATIONS, GAS COMPANIES, &c.

Results unrivalled. Send for Particulars and Prices. All sizes from 50,000 to 5,000,000 Cubic Feet of Gas per day.

MAKERS OF GASHOLDERS OF ALL SIZES, AND GAS AND CHEMICAL PLANT GENERALLY.

Illustrated Catalogues, Post Free, on Application.

London Office: 80, CANNON ST., E.C. Telegrams: "IGNITOR."

Works: HUDDERSFIELD. Telephone 113.

Telegrams: "HOLMES, HUDDERSFIELD."

WEST'S GAS IMPROVEMENT COMPANY, LTD.,

ALBION IRON-WORKS, MILES PLATTING, MANCHESTER.

AND

104, Queen Victoria St.,

LONDON, E.C.

WEST'S

MANUAL

AND

POWER

MACHINERY

FOR

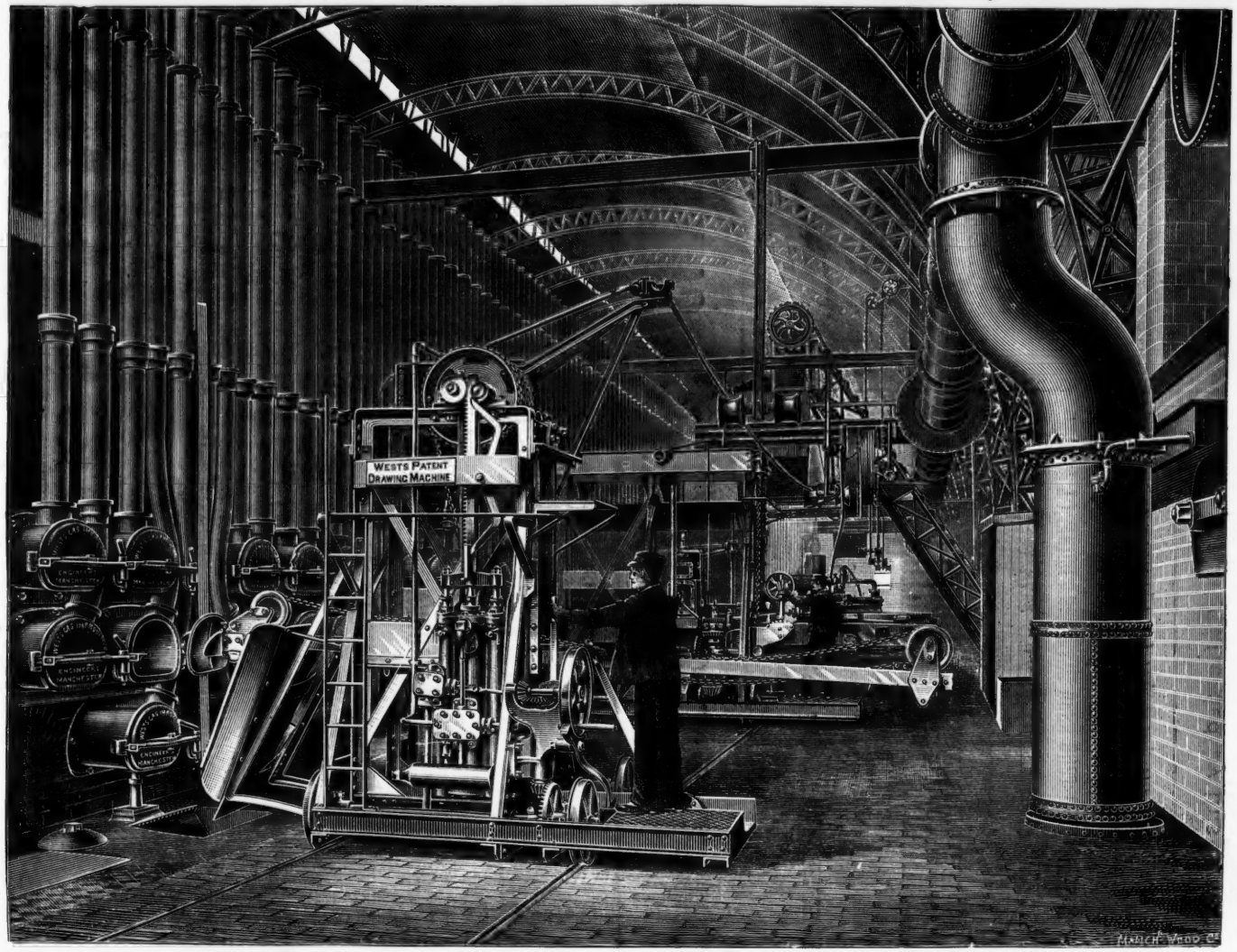
CHARGING

AND

DRAWING

GAS-

RETORTS.



Interior of Retort-House at the Bradford Road Gas-Works, Manchester, showing the Compressed-Air Drawing and Charging Machines.

AND

104, Queen Victoria St.,

LONDON, E.C.

OVER

560,000

LINEAL

FEET

OF

RETORTS

DAILY

ARE CHARGED

AND DRAWN BY

WEST'S

MACHINES.

THE

MAXIM PATENT CARBURETTOR

FOR ENRICHING GAS IN BULK.

Over 50 Maxim Patent Carburettors have now been fixed, capable of enriching

650,000,000

CUBIC FEET OF GAS PER DAY.

Among the Companies supplied are The Gaslight and Coke Company, the South Metropolitan Gas Company, Birmingham Corporation, Manchester Corporation, Rochdale Corporation, Bristol Gas Company, and many other Works, both large and small, where they have been working in some instances for the past **FOUR YEARS.**

More Gas and saleable Coke per ton of Coal Carbonized is produced; saving Capital Labour, Fuel, Wear and Tear, &c.

The Enrichment is **INSTANTANEOUS** and **PERMANENT.**

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

SOLE AGENTS FOR REDWOOD & CLOWES' INFLAMMABLE VAPOUR & GAS DETECTORS.

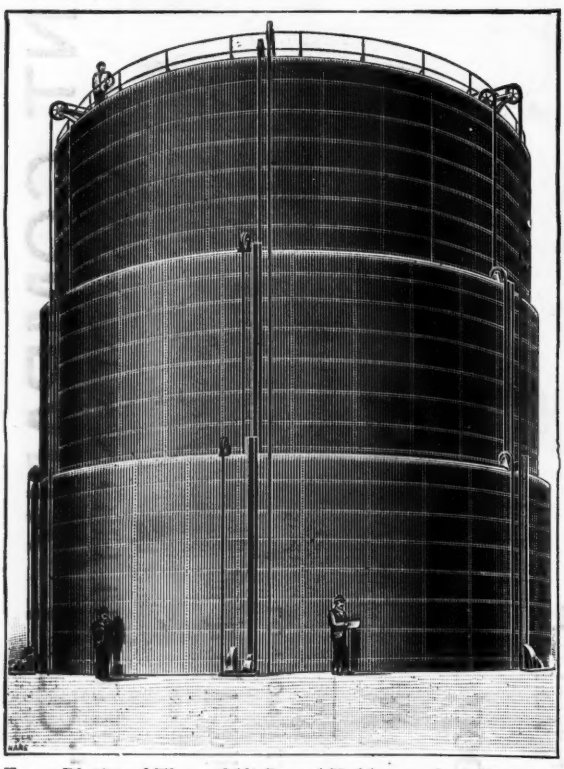
FOR PRICES AND FULL PARTICULARS, APPLY TO

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

18, DEVONSHIRE STREET, BISHOPSGATE, LONDON, E.C.

Dealers in Carburine and all other Naphthas for the Enrichment of Gas.

ASHMORE, BENSON, PEASE, & CO., LIMITED,



From Photo. of Three-Lift Roped Holder, 50 feet diameter by 18 feet deep each Lift. Erected at Sligo, 1894.

GAS-WORKS CONTRACTORS,

STOCKTON-ON-TEES.

Pease's Patent Roped Gasholders

THESE HOLDERS HAVE WORKED SUCCESSFULLY UNDER EVERY TEST TO WHICH THEY HAVE BEEN SUBJECTED SINCE 1889.

MAY BE SEEN AT MANY PLACES.

Send for Catalogue if requiring increased Storage.

The security afforded by this System is shown by the working of the Three-Lift Holder, the subject of this engraving; not only was the Holder unaffected by the recent heavy gales, but also the recorded strain on the Ropes was remarkably small.

London Office: 15, VICTORIA STREET, S.W.

Telegrams { "GASHOLDER, STOCKTON-ON-TEES." "APPARATUS, LONDON."

THE FIRST PRACTICAL AUTOMATIC GAS-METER

Was Manufactured under the Patents of

The Automatic Gas-Meter Company, Ltd.,

Whose present Automatic Gas-Meter is absolutely

"UNBREAKABLE, UNFAKEABLE," AND THE BEST IN THE MARKET.

CAN BE ORDERED TO TAKE EITHER PENNIES OR SHILLINGS.

LONDON: 49, Queen Victoria Street, E.C. | **MANCHESTER:** Factories: Upper Brook Street, & Rosamond Street East. | **LEEDS:** 5, Merrion Street.

Engineer: T. GARDINER MARSH.

Telegraphic Address: "Robustness, London." Telephone No. 1756.

J. & H. ROBUS,

ENGINEERS & CONTRACTORS FOR GAS & WATER WORKS,

20, Bucklersbury, London, E.C.

RETORT-SETTING & Gaseous Firing a Speciality.

MAIN LAYING,

AND THE ERECTION OF GAS AND WATER PLANT OF EVERY DESCRIPTION,

INCLUDING SINKING WELLS AND BOREHOLES.

GASHOLDER TANKS.

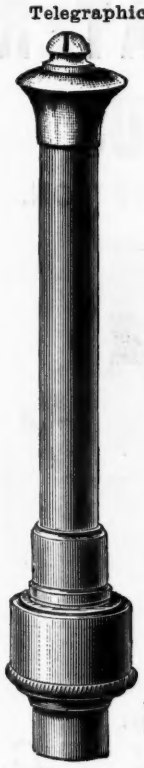
Established 20 Years.

GEORGE ORME & CO.,

MANUFACTURERS OF IMPROVED WET AND DRY GAS-METERS,

ATLAS METER WORKS, OLDHAM.

Telegraphic Address: "ORME OLDHAM." National Telephone No. 93, OLDHAM.



No. 200.

WET GAS-METER IN CAST-IRON CASE.

DRY GAS-METER IN STRONG TIN-PLATE CASE.

ORME'S GAS REGULATOR FOR STREET LAMPS.

AS ILLUSTRATION NO. 200.

Adopted by the leading London and Provincial Gas Companies More than 150,000 now in use.

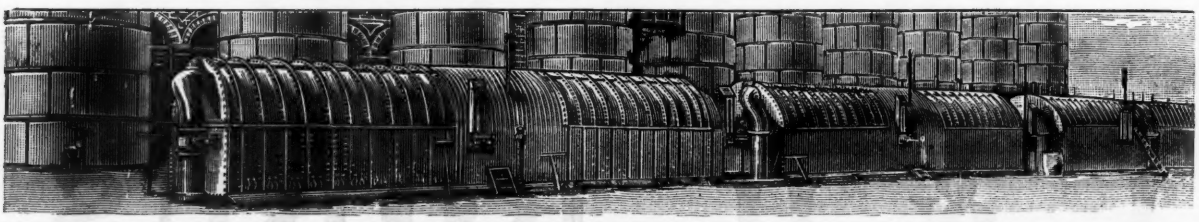
Main Gas Cocks, Pressure Gauges, & all descriptions of Gas, Water, & Steam Fittings in stock.

Illustrated Price Lists and full Particulars on application.

KIRKHAM, HULETT, & CHANDLER, LD.

PATENT "STANDARD" WASHER-SCRUBBER

☞ **492** of these Machines (capable of dealing with **472,540,000** cubic feet of Gas daily) in use, which fact is given as evidence of this apparatus being the Most Efficient of any in the Market for the extraction of Ammonia, Carbonic Acid, and Sulphuretted Hydrogen from Coal Gas.



View of SIX PATENT "STANDARD" WASHER-SCRUBBERS, erected at the Beckton Station of The Gaslight and Coke Company (the Engines driving same being under Galvanized Iron Covers). This Company have 30 of these Machines in use. They are also in operation at a great number of Gas and other Works in this Country and Abroad.

MARSHALL'S PATENT BATTERY CONDENSER & SCRUBBER.

This apparatus being made in sections, the capacity can be easily and cheaply made proportionate to increased make of Gas. Other advantages are: Large and effective cooling area on small ground space, slow speed, no repairs required, high strength liquor obtained, &c.

MARSHALL'S PATENT TAR-EXTRACTOR.

Extracts practically all the Tar without choking up, and gives minimum back-pressure.

3 & 4, Palace Chambers, Bridge Street, Westminster, S.W.

R. LAIDLAW & SON

ENGINEERS & IRONFOUNDERS.

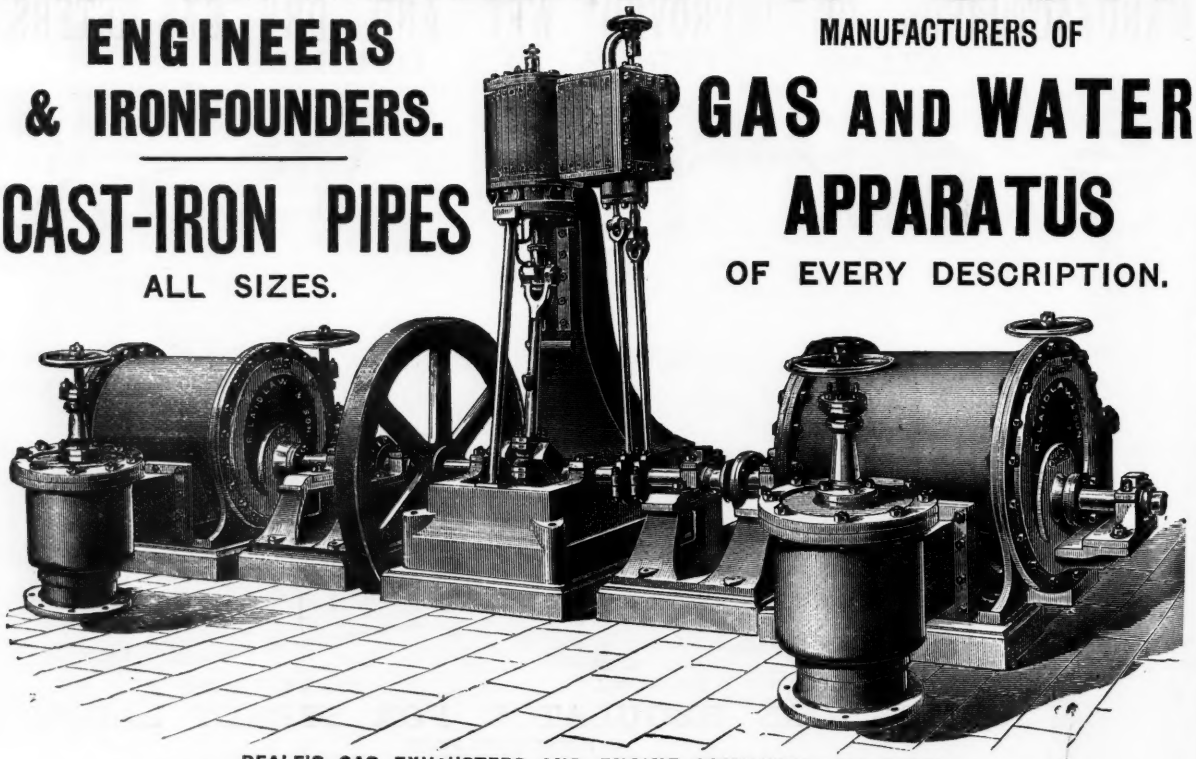
MANUFACTURERS OF

GAS AND WATER APPARATUS

OF EVERY DESCRIPTION.

CAST-IRON PIPES

ALL SIZES.

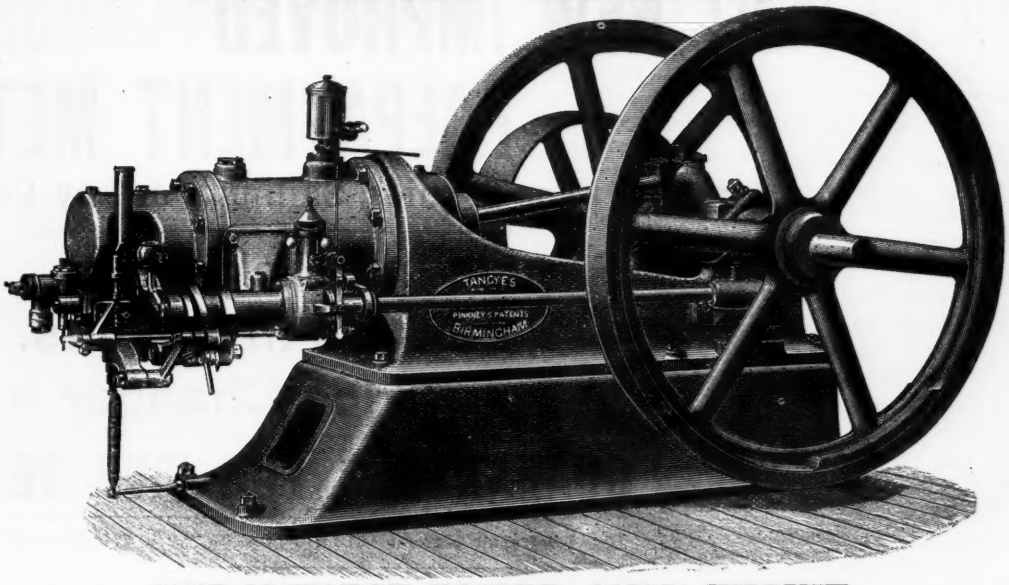


BEALE'S GAS EXHAUSTERS AND ENGINE COMBINED—ALL SIZES.

ALLIANCE FOUNDRY, GLASGOW. | SIMON SQUARE WORKS, EDINBURGH. | 6, LITTLE BUSH LANE, LONDON, E.C.

TANGYES GAS-ENGINE

"OTTO" PRINCIPLE. PINKNEY'S PATENTS.



THE 12-HORSE POWER (NOM.) ENGINE.

ENGINES OF ALL SIZES.

TANGYES LIMITED, BIRMINGHAM;

AND AT

LONDON, NEWCASTLE, MANCHESTER, GLASGOW, SYDNEY, JOHANNESBURG, BILBAO, ROTTERDAM, and BELFAST.

Telegrams: "TANGYES, BIRMINGHAM." No. 98 E.

THE HORSELEY CO., LTD., TIPTON, STAFFORDSHIRE.

MAKERS OF

GASHOLDERS & GAS PLANT.

PURIFIERS, SCRUBBERS, CONDENSERS, WASHERS, TANKS, VALVES,

PIPES, LAMP PILLARS, RETORT-FITTINGS, ETC.

ALSO ALL KINDS OF

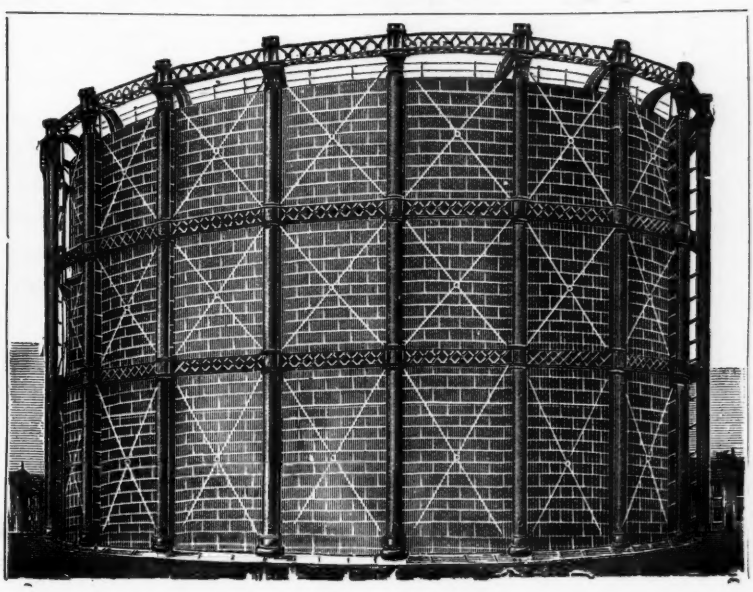
STRUCTURAL IRON

AND STEEL WORK.

BRIDGES,

ROOFS,

PIERS, ETC.



WORKS AND HEAD OFFICE

TIPTON,

STAFFORDSHIRE.

LONDON OFFICE:

11, VICTORIA ST.

WESTMINSTER.

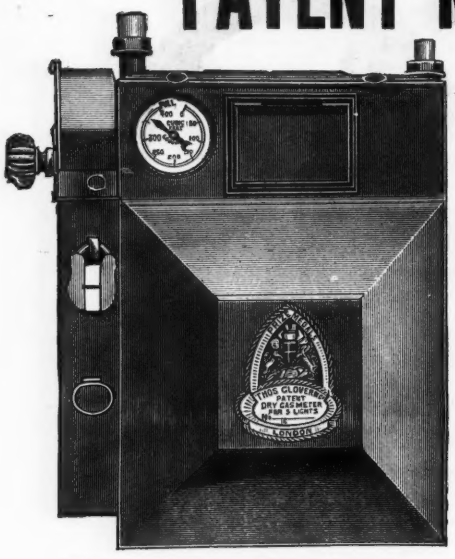
TELEGRAPHIC ADDRESSES:

"HORSELEY, TIPTON."

"GALILEO, LONDON."

THOMAS GLOVER & CO.'S

PATENT NEW IMPROVED PREPAYMENT METER



For Pennies, Shillings, or any Coin.

Simple in Mechanism.
Positive in Results.
Price Changer *in Situ.*

GUARANTEED FOR FIVE YEARS.

Telegraphic Address: "GOTHIC LONDON." Telephone No. 6725.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

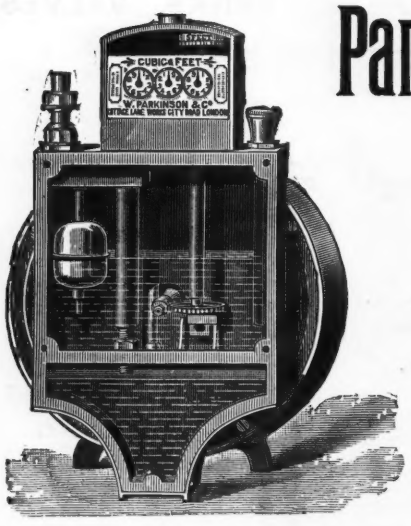
214 to 222, ST. JOHN ST., CLERKENWELL GREEN, LONDON, E.C.

BRISTOL:	BIRMINGHAM:	MANCHESTER:
62, VICTORIA STREET.	3, BRIDGE ROW, DERITEND.	37, BLACKFRIARS STREET.
Telegraphic Address: "GOTHIC."	*Telegraphic Address: "GOTHIC."*	*Telegraphic Address: "GOTHIC."*

W. PARKINSON & CO.

MANUFACTURERS OF WET & DRY METERS.

OLDEST ESTABLISHED FIRM IN THE TRADE.



Parkinson's Cast-Iron Case Meter.

Works with very little friction.

Will stand very high pressures.

Cannot possibly be shut off by sudden increase of pressure; the float being affected by outlet gas only.

Allows for loss of water by evaporation without materially affecting the registration or shutting off the gas.

Unexcelled for Simplicity of Construction, Excellence of Workmanship, and Accuracy of Registration.

COMPENSATING METERS,

In Tinned or Cast-Iron Cases.

COTTAGE LANE WORKS, CITY ROAD,
LONDON.
Telegraphic Address: "INDEX."

BELL BARN ROAD WORKS,
BIRMINGHAM.
Telegraphic Address: "GAS-METERS."

CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE
The Report of the Committee on Weights and Measures . . . 73
Mr. M'Crae on Labour in Gas-Works 74
More Trouble for Salford 74
The Meeting of the Société Technique 75
WATER AND SANITARY AFFAIRS—
The Collapse of the Water Inquiry 75
The Future of the Metropolitan Water Question 76
THE INCORPORATED GAS INSTITUTE:—
PROCEEDINGS AT THE THIRTY-SECOND ANNUAL MEETING—
Papers and Discussions (*continued*)—
The Management of, and Remuneration to, Gas Workers. By J. M'Crae, of Dundee 76
Matters of Interest in Connection with the Washing of Crude Coal Gas. By Lewis T. Wright, of London 81
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market 86
Electric Lighting Memoranda 86
Groves and Thorp's "Chemical Technology" 87
The Portsmouth Corporation and the Water-Works 88
NOTES:—
Lord Rayleigh on Argon 80
Moissan on Willson's Calcium Carbide 89
The Crystallization of Iron 89
The Principle of the Pohle Air-Lift 99
TECHNICAL RECORD:—
Western (U.S.A.) Gas Association—Annual Meeting at Pittsburgh . 90
REGISTER OF PATENTS:—
Atmospheric Gas Burners—Wright, G. E. 92
Gas Motor Tramcars—Holt, H. P. 92
Retorts—Teissier, N., and Nègre, G. L. A. 92
Prepayment Gas-Meters—Simmonds, H. 92
Igniting and Extinguishing Gas-Jets Simultaneously from a Distance—Morstein, O. von 93
Gas Burner Regulators—Feeny, V. I. (Faultless Gas-Saver Co.) . 93
Overhead Regenerative Gas-Lamps—The Lamp Manufacturing Company, Limited, and Welch, W. H. I. 93
Patent Notices 93
CORRESPONDENCE:—
Professor Lewes's Report on English Gas Fires, Stoves, &c. . . 94
PARLIAMENTARY INTELLIGENCE:—
House of Lords—Progress of Bills 94
House of Commons—Progress of Bills; Bills Suspended . . . 94
House of Commons Committees—London Water Bills; The Salford Corporation Gas Provisional Order 94
LEGAL INTELLIGENCE:—
The Litigation between the Alliance Gas Company and the Dublin Corporation 95
The Arbitration between the Yeadon Water Company and Wright 95
Deposits and Contracts 95
Bythesea *v.* Stroud Water Company 95
MISCELLANEOUS:—
Nottingham Corporation Gas Supply—Annual Reports of the Gas Committee and Engineer 96
Coventry Corporation Gas Undertaking—The Disposal of the Profits 96
Brighouse Corporation Gas Undertaking 96
Large Gas-Works Extensions at Wallasey 97
Electric Lighting Notes 97
The New Water-Works for Bilston 97
Notes from Scotland 97
Current Sales of Gas Products 98
Coal Trade Reports 98
Gas and Water Companies' Stock and Share List 100
PARAGRAPHS:—
Title and Index to Vol. LXV.—The Examinations in Gas Manufacture—The Management of the Rotherham Water-Works—Death of Ex-Bailie Ure—The Metrical System for England . . 86
The Sale and Burning of Mineral Oils 87
Institution of Civil Engineers—The Physical Properties of Acetylene—Incandescent Gas Lighting for Winchester—Society of Arts—Society of Engineers 89
Extensions at the Matlock Bath Gas-Works—Lisburn New Water-Works—The South Staffordshire Water Company and the Water Supply of Wednesbury—The Production of Gas at Oldham . . 91
Belfast Corporation Gas-Works—Compensation in Respect of an Easement for a Water Conduit of the Bradford Corporation . . 93
New Water Pumping Machinery for Liverpool—New Water Reservoir for Preston 94
A Supply of Water for Wilsden from Bradford—The Water Supply of Newcastle 95
Extensions at the Halifax Gas-Works—The "Penny-in-the-Slot" System at Burnley—The Darwen Corporation Gas and Water Undertaking—Burglary at the House of Mr. W. R. Cooper, of Banbury—The Public Lighting of West Hartlepool—The Whittington District Council and the Gas-Works—Unaccounted-for Gas at West Bromwich—Sales of Shares—New Joint-Stock Companies—Gas-Works Extensions at Bangor, Ireland 99
Reduction in Price—Improvements at the Chorley Gas-Works—Proposed Improvements at the Knaresborough Water-Works—The Scarcity of Water in South Wales; Proposed Purchase of the Ystrad Water-Works—New Boiler for the Lymm Gas-Works—A Hitch in the Oil-Gas Experiments at Bradford—Exhibitions 100

TO SUBSCRIBERS.

The JOURNAL is published every Tuesday, price 6d.; by post, 6½d.

TERMS OF SUBSCRIPTION.

One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.

Payable in Advance.

If credit is taken, the charge is 25s. a year.

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Second Half of the Year, are reminded that this can only be done during this month.

All communications, remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

EDITORIAL NOTES.

The Report of the Committee on Weights and Measures.

A HIGHLY interesting report from the Select Committee on Weights and Measures, with a summary of the proceedings of the Committee, has just appeared as a parliamentary paper. The Committee were appointed in February last "to inquire whether any and what changes in the "present system of weights and measures should be "adopted," and numbered in all seventeen members—Sir Henry Roscoe being Chairman. They now state that they have considered the matters referred to them, and have agreed upon a unanimous report which strongly favours the legalization and adoption of the metrical system of weights and measures by England. In the course of their inquiry, the Committee took evidence from witnesses representing many different interests, and also received from numerous corporations, school boards, and other public bodies, resolutions without exception in favour of the adoption of the metrical system. Almost all the witnesses expressed a strong opinion as to the complicated and unsatisfactory condition of our present weights and measures. The evidence goes to show that not only is our foreign trade, in every branch, seriously handicapped, but that the home trade would be benefited if more simple and uniform standards of weights and measures than those now existing were adopted. Strong evidence was brought forward as to serious loss of time incurred by English school children in having to learn the complicated system of tables of existing weights and measures, and the urgent need of the adoption of a simpler system. Moreover, it was proved to the satisfaction of the Committee that a compulsory change from an old and complicated system to the metrical had taken place in many European countries without serious opposition or inconvenience, and that the change was appreciated. Consequently, the Committee recommend that the metrical system of weights and measures be at once legalized for all purposes; that after a lapse of two years the system shall be rendered compulsory; and that it be "taught in "all public elementary schools as a necessary and integral "part of arithmetic, and that decimals be introduced at "an earlier period of the school *curriculum* than is the case "at present." Thus is the principle in arithmetic of Dr. Colenso—terror of many schoolboys who are now greybeards—justified by the wisdom of Parliament. It must be remarked, however, in justice to the Colenso-hating schoolboy of the fifties and sixties, that decimal arithmetic is not always the same as a decimal system of weights, measures, and currency.

When we receive the printed evidence, we shall be in a better position to criticize the findings of the Committee. Meanwhile, it may be admitted that public feeling has been gradually coming round to the view so unequivocally expressed by the Committee. The totally different subject of the currency apart, there can be no question about the complication and confusion that characterize our British "Table Books"—so oft bedewed by the tears of the wretched schoolboy, whose sluggish reason cannot help him to understand either the nomenclature or the subdivisions of our standard system of weights and measures. When he becomes a man of science, the schoolboy makes a way for himself out of these troubles by artfully "bye-"passing" the illogical intermediate weights and measures, or, as a chemist, he boldly thinks and talks in the metrical system—no man forbidding him. Thus busy people have a way of passing mentally from yards to miles, from pounds avoirdupois to tons; or they take a weight or a measure as a point of departure, and express all its fractions as decimals. Yet it is no easy task to teach children to use and reckon by decimals, when the ordinary transactions of life are not carried on by the same system of weights, measures, or coinage. The British coinage must, of course, remain unchanged. Would that sovereigns in private ownership would exhibit the same steadfastness! But, *pace* the Committee, our old-fashioned weights and measures had better go. People will soon get used to asking for half a kilo. of tea. The late Professor Rankine's typical workman declared his resolve to "eat by the pound, and drink by the quart, "and work by his two-foot rule." But the spirit of the time is too strong for the Professor's successors; and there is no valid reason why England should cherish an

antiquated system of weights and measures unintelligible to the rest of the civilized world, and anything but convenient to those who use it.

Gas engineers, at least, will not object, on principle, to deal in cubic metres of gas in place of thousands of cubic feet, though, in sooth, the new unit will be somewhat small and difficult of adjustment to the coinage. There will be no possibility of marking such gradations of price as a penny per 1000 cubic feet up or down in even fractional currency; for a farthing per cubic metre is very nearly equivalent to 7d. per 1000 cubic feet. For the moment, we do not exactly see how this difficulty is to be overcome. In one respect, however, gas engineers will look favourably upon the metrical system. It is their only hope of deliverance from the absurd way in which the degree of purity of coal gas is expressed. It has often been complained that the system of stating sulphur impurities in grains per 100 cubic feet was ingeniously devised to place in juxtaposition a high numerical expression for the impurity and a low one for the gas, so as to convey to ignorant persons an altogether erroneous idea of the relative proportions of the two quantities. When the metrical system is legalized, this little imposition will be quietly consigned to the limbo of things missed, but not wanted. We shall no longer hear of grains of sulphur and cubic feet of gas, but of percentages of impurity to commodity, which will put a very different aspect upon the question of purification. It will be an interesting exercise for the Gas Referees to translate their requirements into metrical terminology. No help in this connection can be derived from French practice, for the French users of the metrical system do not test coal gas for sulphur or ammonia. They are content with the test for sulphuretted hydrogen; and if the acetate of lead paper does not blacken in a quarter of an hour, or the time allotted for the photometrical observation of the same gas, they are perfectly satisfied with the gas.

Mr. M'Crae on Labour in Gas-Works.

The influence of the Journal teaching was apparent in several of the papers read at the recent Gas Institute meeting; a good example being the paper by Mr. John M'Crae, of Dundee, upon "The Management of, and "Remuneration to, Gas Workers," and the spirited discussion which followed the reading of it by the author, who, by the way, proved himself a smart debater in dealing, in his reply, with his critics and commentators. There is nothing novel in the paper, which was mainly intended to show how very comfortably Mr. M'Crae's men work at Dundee. But the fact of such a paper being included in The Gas Institute transactions, and eliciting so long a debate, is proof that there is general interest among gas managers in those Labour questions to which it has been our policy to devote much space and particular attention. Mr. M'Crae is an eight-hour man; the three-shift system having been in vogue in Dundee, as he told his audience, for the past twenty-four years. He employed some rather strong language in advocacy of this system, and in condemnation of the alternative two-shift division of the gas-workers' day. We do not regard the difference as a matter about which to throw stones. Where men are required to work the twelve-hour shift, turn and turn about, year in and year out, with no relief whatever from Sunday labour, no days off, and no holiday, we have no hesitation in characterizing the condition of their toil as simply organized cruelty, and a shame to their managers and employers. It is only too true that this was the condition generally prevalent in gas-works, especially of sizes from small to medium, a quarter of a century ago. It still exists in some backward works, under the thoughtless, or perhaps mercenary, sanction of managers, directors, and corporation committeemen who have been too long familiar with the arrangement to see anything wrong in it, especially as stokers who have grown up under it are usually contented with their lot. Talk about the exhausting nature of stokers' work and their slavery to long hours is not impressive to managers who, though perhaps not getting the utmost out of their men, probably know of the same gangs working on for many years without wearing out more than ordinary day labourers. With shovel work in country retort-houses, men have been known to keep going for forty years and more before passing into a hale old age with a pension. But this is not the point. The things to be regarded are the indubitable facts that what served well enough as a condition of labour for the last generation will not answer to-day; and that what does best in one locality and set of circumstances is not necessarily best for all. In one district, the men available for retort-stoking work may be of a fairly high class, who appreciate refinements in their surroundings and the rule of kindness and consideration in their treatment. Elsewhere they may be the dregs of a particularly rough population, whom no gas manager would have dealings with on any terms, if he could help himself. The gas manager does not make his men what they are, but must take what he can get. It is all very well to preach the saving virtue of gentleness; but the truth is not yet out of the old proverb which tells us that it is impossible to "make a silk purse out of a sow's ear." Mr. Alderman Miles and Mr. Hutchinson have both had recent experiences of the point of this saying.

While the respective virtues of the eight-hour and twelve-hour shifts were dealt with in Edinburgh in a somewhat cursory fashion by Mr. M'Crae and others, nobody really went into the heart of the matter on that occasion. When this is done, the actual amount of work accomplished by the men under each system, as measured by the weight of coal carbonized per man, must not be overlooked. The eight-hour man is required to do more while he is at it, in every three-shift works that we know of, than does the two-shift man. The former has to work harder in every hour of his shift than the latter. Nor, for all Mr. M'Crae's warm asseveration, is it true that a twelve-hour shift in the retort-house means twelve hours of work in the same sense as the navvy, the bricklayer's labourer, or the harvester knows the term. While, therefore, any of these descriptions of labourers are required, as a natural thing, to work nine, ten, or more hours a day, it cannot be reasonable to stigmatize the twelve-hour shift as "wrong." Nothing good was ever effected yet by using ethical considerations out of their proper connection. With regard to the remarkable speech made by Mr. William Carr upon the inhumanity of those engineers who favour labour-saving machinery for gas making, it is sufficient to say that what he appeared to uphold as the duty of gas managers in this respect is tantamount to the negation of all mechanical progress. If he is to be esteemed a benefactor of mankind who makes two blades of grass grow where only one grew before, he is not less so who delivers mankind from toil that can be as well, or even better, done by mechanism. Mr. Carr was, however, sufficiently answered by Mr. Denny Lane and by Mr. Stelfox. It is difficult at this time of day to take seriously such observation as those made by Mr. Carr.

More Trouble for Salford.

The Corporation of Salford have had a disagreeable experience in connection with their Provisional Order for increased capital powers for gas purposes. They desired to raise £85,000 in addition to their existing borrowing powers; and they endeavoured to obtain statutory authority for this apparently innocent and routine proceeding by the usually convenient way of a Provisional Order. The result, however, has illustrated once more the deceptive nature of the system followed, which is only cheap and expeditious when the powers asked for are not seriously objected to. In this case, the Bill to confirm the Order was strongly opposed by the Swinton and Pendlebury District Council, with the remarkable result that the Committee imposed such terms upon the Corporation as to cause them to withdraw the Order. And, more wonderful still, the Committee gave it as their unanimous opinion that the Swinton and Pendlebury authority should have their costs as against the Corporation. We believe the latter decision to be without precedent. Upon the face of the record, it looks as if Salford had been hardly done by; but the "true inwardness" of the matter does not appear on the surface. The trouble goes back as far as 1891, when certain outlying districts supplied with gas by Salford including Swinton and Pendlebury, successfully combined to put an end to the systematic and excessive "milking" to which they were subjected by means of differential prices, the benefit of which went wholly to the supplying authority. Swinton and Pendlebury, with Eccles, were to have had their own gas-works as a prize of victory; but before a Bill could be promoted to carry into effect the opinion of the 1891 Committee, Eccles withdrew from the combination—being content with the reduction of the differential rate to 2d. per 1000 cubic feet, and not fancying a gas-works in the district. Swinton was ready

to go on; but was in turn successfully opposed by Salford. Since 1892, however, the financial affairs of the borough have been moving, as everybody knows, along a very questionable road. A large sum of money has been lost sight of, somehow; and, as the natural consequence, the Gas Committee have paid over tremendous subsidies to help to straighten out the Corporation accounts. This course of robbing Peter the gas consumer to pay Paul the ratepayer, might, Swinton thought, be very good fun for Salford; but there was no sound reason why Swinton should suffer for the sins of Salford, especially after obtaining a decree *nisi* for the dissolution of the union of the two districts. Consequently, when Salford applied for another £85,000, Swinton seized the opportunity for telling Parliament all about its municipal misdeeds.

Mr. Balfour Browne did all in his power for the promoters of the Order; but the best plea he could raise on their behalf was that, after all, Swinton only paid 2s. 6d. for the gas that is sold in Salford for 2s. 4d.—which price, he contended, was a very low one indeed. Swinton was but an insignificant customer of Salford—only taking about one-sixth of the total output of gas; and why should there be all this grumbling over so trifling a matter? Well, he had his say, and marshalled his witnesses. But, without calling upon those for the other side, the Committee found that the Salford Gas Committee were treating Swinton unfairly. It was not a question of whether such gas as Salford sent to Swinton was low priced or not, but of what it cost to produce, and the amount of profit realized by Salford. It was found that Salford was making about 13 per cent. profit on the corrected gas capital, and paying several separate and distinct kinds of subsidies out of the revenues of the gas undertaking. The Committee thought that Swinton had a right to protection from this policy; but when this opinion was declared, the promoters withdrew their Order rather than accept the protective clauses to which Swinton was held to be entitled. Then the Committee made that memorable pronouncement with respect to the Swinton costs already mentioned, and included in their report to the House. It was considered, in effect, that a big municipality should not be encouraged in persistent attempts to ride roughshod over a little neighbour, or to wear down righteous opposition by repeated applications to Parliament which no small district could afford to as repeatedly oppose.

For more reasons than one, this parliamentary victory of Swinton over Salford is worthy of being signalized as one of the leading events of the year in gas politics. It effectually exposes the weakness, and insufficiency to bear the stress of parliamentary opposition, of the cardinal principle by which British municipalities owning gas-works are in the habit of fixing the price of gas—the idea that, when the municipality, with one eye upon the price of gas and the other upon the needs of the municipal treasury, resolve that the gas is "cheap," or "cheap "enough," nobody else has a right to say another word on the subject. It is the excuse of "cheap enough," in regard to municipal gas, that enables corporations to plunder the gas consumer with all the pretence of doing him a service. "In the time of the old company," the argument runs, "you were paying 4s. 6d. per 1000 cubic feet "for gas; now you get it for half-a-crown. Buy freely of "us, therefore, and be grateful." No mention is made of the cost at which the gas could be sold if it were not for that terrible hole in the municipal treasury which the gas consumer must stop, since there is nobody else to do it. This Swinton opposition to Salford has at least exhibited, in all its futility, the only plausible excuse for municipal oppression of the gas consumer. There is plenty of scope for further use of the argument by which Mr. Bidder discomfited Mr. Balfour Browne on Friday.

The Meeting of the Societe Technique.

The French gas managers had a very successful meeting in Paris during the week following the meeting of The Gas Institute, under the presidency of M. de Lachomette. The attendance was large; and the quality of the papers was exceptionally high. The President devoted a large portion of his address to the consideration of the changes that take place in gas coal after its extraction from the mine and before its carbonization; and much that he had to say upon this important subject was highly instructive and suggestive. The various devices that have been introduced in France as in other countries, during the last year or two, with the object of popularizing the use of gas, were also discussed by the President in a statesmanlike spirit. Some communications were made to the meeting upon the handling of coal by machinery, and one paper described what appears to be a re-invention in a French form of West's hand-power stoking machine. M. Godinet presented a long memoir upon the subject of condensation; giving a description of the system adopted at the Vichy Gas-Works. Incandescent gas lighting, calcium carbide, water gas, the sale of coke, the manufacture of ferrocyanide of potassium, automatic prepayment meters and gratuitous fittings, and the comparison of electrical with gas cooking, were among the numerous subjects brought before the meeting. M. Denayrouze was present, and exhibited his improved incandescent gas-burner, for which he put forward the claim that with an almost infinitely small supply of electricity and a large quantity of gas, very much more was done than either agency could accomplish by itself. It is satisfactory to learn, from the proceedings at the meeting, that the automatic prepayment meter seems to have "caught on" in France as completely as it has done in England. M. Melon has had gratifying success at Lille with this means of popularizing gas, which is just the thing wanted for a working-class community. He has doubled the number of consumers in two years, although gas is twice as dear as it would be in an English manufacturing town of the same size. Even so, it is able to compete with petroleum when the consumer is not asked to pay anything for fittings. It appears that French Gas Companies, as a rule, are open to put up fittings and send a prepayment meter to any householder who asks for them. The French gas managers are to be congratulated on their enterprising spirit, which has vastly widened the horizon of the native gas industry.

WATER AND SANITARY AFFAIRS.

The Hybrid Committee of the House of Commons, appointed to consider the London Water Bills, met on Wednesday, as previously arranged, and forthwith declared its own dissolution, in view of the similar event which awaited Parliament, and which was consummated yesterday. The eight Transfer Bills of the County Council are now either dead or in a state of suspended animation. Palpably, the revival of these Bills in the form in which they originally appeared is impossible. But the recent inquiry is destined to have an effect in the future, as something which yet lives. The policy of the County Council on the water question has been practically rejected; and our contention on Tuesday last that the Water Companies, despite the enormous expense thrown upon them, are really gainers by the result of the recent inquiry, is supported by the Money Article in *The Times* on Thursday, which said: "The labours of the Committee, and of others engaged in "the inquiry, have not, however, been thrown away." For it is now rendered clear, we are told, that if ever there is a transfer of the London water undertakings, the shareholders may expect "no less satisfactory consideration than has been "bestowed hitherto upon all other owners of valuable pro-"perty subjected to compulsory purchase." Such was our own interpretation of the remarks made by Mr. Plunket, accompanied by the decisions of the Committee on several points. That anything else should ever have been anticipated, indicates the unreasoning violence of the prejudice which had been raised against the Metropolitan Water Companies by the County Council, aided by a considerable portion of the public Press. It was deemed by the latter a popular line to attack the Water Companies; but it has at length been seen that the blow aimed at them must necessarily strike deeper and farther, involving many other interests than the one immediately assailed. As a sequel to the recent contest, we have declared that the water question no longer stands where it did. Of this we are the more assured by the circumstance that the minutes of evidence taken before Mr. Plunket's Committee are ordered to be printed. They will thus become a record for the guidance of the parties conducting future inquiries, and will serve as a starting-point in any investigations yet to be entered upon as to the water supply of the Metropolis.

We may also observe, as calling for some remark despite its formal character, that among the printed votes and proceedings of Parliament on Friday there is a report from Mr. Plunket on behalf of the Hybrid Committee, stating that, in the case of the Lambeth Water (Transfer)

Bill, the further consideration of the measure had been arrested by the approach of the dissolution of Parliament. In reference to the Southwark and Vauxhall Water (Transfer) Bill, and the Bills brought in by the Lambeth and Chelsea Companies, the Committee were, for the like reason, of opinion that the consideration of the said Bills "should not be entered upon" during the present session. The Committee thus appear as having done nothing beyond giving a partial consideration to the Bill for the acquisition of the Lambeth undertaking. But the truth is that the Committee have threshed out a large portion of the general question relative to the management of the Metropolitan Water Supply. As for the six Transfer Bills not named in the Committee's report, they dropped far in arrear, and were put down for a second reading on the 29th inst. The Transfer (Money) Bill was 66th on the orders of the day for Friday last. The mere arrest of the legislation projected by the County Council relative to the water supply would be of less significance, were it not that conclusions have been reached which practically involve a decision on the merits of the measures which have thus fallen through, or are at least held in abeyance.

The Transfer Bills are virtually a wreck, and will require considerable patching up if ever they are to float again. The arbitration scheme, by which the property of the Water Companies was to be depreciated to the verge of nothingness, is demolished. Compensation is to be allowed for compulsory sale. All the Companies are to be bought at one time; and they are not to be divided into sections for destruction. Transfer before purchase has not been approved. Such is the situation in which the Hybrid Committee have left the famous "acquisition" project. The decisions and opinions of the Committee may not have the force of law; but they command respect, and Parliament will not ignore them. The recommendations made some years ago by Sir Matthew White Ridley's Committee, and the conclusions arrived at by the Royal Commission under Lord Balfour of Burleigh, were recognized by the Hybrid Committee; and a like recognition will be given to the views expressed by the latter. The County Council must now trim their sails for a new tack. The Transfer Bills must be remodelled, in order to have any chance in the Parliament of 1896. As for bringing in a scheme to give London a supply from a remote watershed, such a project would have no prospect of acceptance with the Legislature, unless accompanied by a just arrangement with the Water Companies. But in whatever shape the Metropolitan Water Question comes before the new Parliament, it is important that one omission in respect to the recent inquiry should be rectified. The County Council cling to the notion that the Select Committee recognized them as the "one authority" that was to fulfil the condition laid down by Sir Matthew White Ridley's Committee, by possessing the entire water supply of the Metropolis. The Hybrid Committee refused to be pledged to that view while the inquiry was proceeding; but Mr. Plunket signified that they were excluded from considering any "alternative plan" by the circumstance that none of the petitions proposed any—the opposition simply confining itself to an objection to the County Council. This negative position was unfortunate; and it should be amended in the future. The consideration, however, is one which affects the public more than it concerns the Companies. The latter have no desire to be bought up by anybody, whether Council, or Trust, or Board. But the *animus* of the Council has been such that the Companies may desire to have business transactions with anybody rather than with them.

The Parliamentary Committee of the County Council, in a report which will be presented to-day, state that they have instructed their Agent to take steps, under the Orders which have been made for the suspension of Private Bills, to suspend all the Transfer Bills "until next session." Concerning the London Water-Works (Money) Bill, the Committee say: "This Bill will, of course, drop in conse-
"quence of the dissolution." With regard to this attempt to renew the existence of the Transfer Bills, it would appear that, as these measures are opposed, the utmost the Council can hope for is to get them taken up next year from the position at which they have now arrived. But there is an apprehension that the proceedings before the Hybrid Committee will have to be gone over again. The Bills of the Chelsea and Lambeth Companies are also suspended by notice.

THE INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE THIRTY-SECOND ANNUAL GENERAL MEETING,

HELD AT THE

QUEEN STREET HALL, EDINBURGH, JUNE 11, 12, & 13, 1895.

ROBERT MITCHELL, Esq., President.

PAPERS AND DISCUSSIONS.

THE MANAGEMENT OF, AND REMUNERATION TO, GAS WORKERS.

By JOHN M'CRAE, of Dundee.

It is with considerable diffidence that I appear before you to-day, and for this reason: Your Institute has ever been so practical in its dealings with the profession, and the response to appeals for papers has been so unanimous, that it seems the very essence of difficulty to fix upon a subject that has not already been thoroughly dealt with. This, then, was the writer's difficulty—fearing I would be unable to add anything of importance to the literature of the gas profession. However, the kindness, and the repeated kindness, of your President and your Secretary (a form of kindness for which, I believe, presidents and secretaries are conspicuous) in begging and re-begging papers prevailed; and I appear to-day with a short paper, the title of which is not in any way inviting. If it falls short of your expectations, I hope you will extend to the writer your kindest forbearance. One thing I am sure you will not grudge me—that is, showing the desire at least of contributing, even in a small degree, to the usefulness of the excellent Institute under whose auspices we are met.

It must be within your knowledge that for several years relations between employers and employed have not been at all satisfactory. Disputes, difficulties, and disturbances have taken place, which in my opinion—especially in regard to gas-works—might have been averted by a conciliatory spirit all round. Gas-works occupy a somewhat isolated position. As a rule, only one works (or, at least, works under one authority) exists in any town or city; and therefore there is no opposition or competition—nor, indeed, can be—and the engineer should be master in every sense of the term. If this idea is correct, then there devolves upon the engineer a responsibility which is by no means light; and if the management is carefully and thoughtfully carried out, then, and in that case, we do not require any assistance or interference from any outside institution whatever.

In the first place, I think it will be admitted that a certain class of gas-workers have very hard and exhausting labour to perform—I refer specially to our gas stokers; and if we are agreed in regard to this matter, it is quite clear that we should so adjust their hours of labour, as to make the strain on their systems as light as possible, consistent with good work, faithful service, and satisfactory returns. The hours of a gas stoker should in my opinion be eight per day; and allow me to quote the experience we have had in Dundee, which I will do as briefly as possible. What I am about to speak of, refers almost entirely to the Dundee Gas-Works.

It is now 24 years since we introduced the eight-hour system, prior to which the men and their mode of working were in a strange state indeed. Twelve hours' work in any retort-house must be a trying and a tiring task; but I am met at once by the statement of a gas engineer of large experience, to the effect that the stoker does not work the whole of his shift, he may be only employed for a portion of the time. This may be perfectly true; for no flesh and blood could possibly charge and empty retorts hour after hour. But is it not a fact that, even if our stokers are not doing constantly such work as I describe, their surroundings are of the most objectionable nature—heat, dust, smoke, and many other contributaries to anything but a comfortable occupation?

When the hours of labour were twelve per day, what was the state of matters? Leaving their work at the end of the day, the men were thoroughly exhausted, or as we

would say in commonplace language, "pumped out." No wonder, then, that they should fly to stimulants of a temporary and unsatisfactory nature; and one could see that their life to them was no enjoyment. The men were worthy men; and I am quite glad to have an opportunity publicly of speaking to their conduct and character. But supposing you think of the change of shift. A man comes to his work at 6 p.m., and he is confined, or partially so, in the retort-house till 12 o'clock noon of the following day. Can anyone listening to me consider, in all fairness, that this is proper treatment of the working men who were so employed?

Now, gentlemen, do not think that I appear before you as a Labour candidate; but allow me to point out that I consider kindness and consideration extended to your workers, is a certain mark or indication of shrewdness, and for this reason: As I have already shown, the twelve-hour shift was wrong; and what has taken place since the introduction of the eight-hour shift is sufficient warranty for what I am about to say. This change in the hours of labour has wrought what I might describe as a miraculous revolution in the conduct of our workers in the retort-houses. The men are practically as fresh at the end of their eight hours as they were at the beginning; and after having their bath, they go home like sensible men, able to take an intelligent part in their family circle. In speaking of this, I do not know whether the erection of bathrooms in gas-works is universal; but I would strongly recommend it, and from what I have stated you will not be surprised at my suggestion.

The next point to which I would make reference is the cost of the alteration in the hours of labour; and this must be an important factor in our calculations. When our men were working on the twelve-hour system, their rate of pay was 4d. per hour; and one could scarcely expect them to accept two-thirds of their former income. This would be unreasonable. We, therefore, arranged with the men that, when the eight-hour shift commenced, their rate of pay should be 5½d. per hour, which meant 3s. 8d. per day, as against their previous 4s. per day. So that the men suffered somewhat; and so did we. Owing to the increase of wages all over the country since the period I refer to, this 5½d. has gradually crept up to 7d. per hour, at which rate it now stands. This certainly means an increase in the cost of management of our works; but I am quite certain that the great majority of gas consumers in our country would not grudge an extra penny or two per 1000 cubic feet of the gas they consumed, when they knew that, but for this penny or two, the men employed in producing the article which adds so much to the comfort and brilliance of their homes, would be subjected to unnecessary exposure and hardship. Speaking in the abstract, the eight-hour day has been a great improvement; and none feel the improvement more, or to a greater extent, than the men themselves. Surely it is more pleasant for ourselves, as gas engineers, to see good results obtained at the least expenditure of bone and muscle of our workers.

Leaving the retort-house, careful attention should, I think, be paid to two other departments. We have spoken of the stokers as being subjected to considerable physical exertion, and to work of an exhausting nature; and there is another class of men who are not subjected to the same strain physically, but have responsibility, which upon the surface may be considered light, but which I am certain every thoughtful gas engineer of experience will consider of great importance—I refer to our valve-men and syphon-men. It may be, and no doubt is, within the recollection of you gentlemen, that on more than one occasion in the inquiry after a railway collision, very pointed and serious comments were made on the long hours of signalmen; and it was also (if I am not mistaken) clearly shown that at least one very serious railway accident resulted from the over-work and consequent exhaustion of the signalman. Well, come to the gas-works, our syphon-men, valve-men, and pump-men, are practically constantly employed. Their work is of an important nature, demanding their visits to nearly every part of our works at regular intervals; and we all know what would be the result of neglect in this department. Having a day of eight hours, and having secured men who acknowledge and can see the responsibility of their work under such an arrangement as I have indicated, we have excellent service, and not an overstrain on the men employed.

One other department to which I feel I must refer—and one I am sure you will all admit is amongst the most important in our profession—is the distribution, and the men employed thereunder. It must be agreed that the distributing department is the one furthest outside the personal control and management of the engineer; and consequently a great amount of responsibility is left in the hands of our subordinates. In the first place, I would say, offer every encouragement to the ready and speedy turning out of workmen during the night to attend to escapes of gas, or other unforeseen circumstances. It is not natural to expect a man to leave his comfortable, although probably humble, home in the middle of a winter's night to attend to any complaint of a nature such as I have indicated, without some substantial remuneration. And allow me to say here, gentlemen, that, having had experience of more than one serious explosion, and been the observer of several cases of suffocation, I feel very much the importance of the subject and the department I am dealing with; and I would strongly recommend that every encouragement should be offered to our employees in this part of our work. It has suited us well in Dundee; and so far as I can see, nothing has been left undone to place the distribution on the best possible footing.

Our arrangements are these: When a pipe-layer or his foreman is called out after working hours, whether with cause or without cause, he receives two hours' wages, and thereafter time and a half; and in cases of extremely severe weather, or on special occasions, refreshments are provided. The result is, by all these arrangements, together with other acts of carefulness, we have been able to reduce our leakage or unaccounted-for gas from 24·641 per cent. to 8·505 per cent. Before leaving this department, one suggestion I would make is to supply all policemen in the city with cards containing the names and addresses of gas officials who may be called upon, by day or night, to attend to escapes of gas. This simple arrangement we have found to work well—aided, of course, by our Chief Constable.

And now, gentlemen, before bringing my paper to a close, there is one class of workers to which I have made no reference—namely, the gas managers; and I feel to be treading on very tender ground, for this reason: I do not wish to appear as the champion of the profession to which I belong; but of one thing I am convinced, that the gas managers of this country have not been well treated. Do not mistake me when I use the words "well treated;" but town councillors, commissioners, or directors, have not the least idea of the difficulties and troubles attending the office of every gas manager. An eight-hour day with them is a thing they read about, but very rarely experience. They must be ready at all times for any emergency; and without any extra remuneration whatever. Now, I would not advocate bringing down the manager to the level of getting (say) time and a half for extra services rendered; but I think he ought to have, to start with, a living wage, or, as would be considered in his case, salary. Imagine this case, which took place quite lately: A gas manager wanted to take the control of a fairly sized gas-works. He must, in the first place, be an engineer; have a thorough knowledge of the manufacture and distribution of coal gas, according to principles embraced by all modern improvements; be quite conversant with regenerative furnaces, and the working-up of residual products; also be able to inspect meters and keep books and accounts. For all these accomplishments, he is offered the munificent salary of £150 per annum, with no emoluments of any kind. Now, a gas manager has to live, and be presentable to the public at all times; and I affirm that in very many cases in our country, it is next to an impossibility for the poor manager to keep his feet clear on the miserable salary he receives. I know of many cases of managers of moderate sized works, careful, anxious, diligent, and thoughtful men, who have large families simply battling with the elements (as it were), and struggling for a decent kind of existence.

Gentlemen, these things ought not so to be. A good paying gas concern should extend to their manager a share of their success; and in nearly every gas undertaking that is not a financial success, the blame lies somewhere else than with the manager, so that he should not be made to suffer. The great difficulty lies in the remedy; and until companies and corporations realize the importance of gas-light in their communities, so long will it be that in many cases those responsible for the due and economical

production of such light will have to go only partially rewarded for their services.

I have now briefly reviewed the departments of gas-works to which the title of this paper refers. I might have alluded to the Sunday labour question; but that has already been dealt with by a very competent gentleman. I might also have referred to the public lighting staff; but this department I thought would not present points of sufficient interest to you. But of one thing I am sure—that it is the duty of every gas engineer to frame rules for the guidance of his workmen, and the control of the work, and make certain that these rules are enforced; and the very fact that they are enforced, means that discipline governs the whole undertaking.

Discussion.

Mr. H. Tobey (Malton) said he was heartily in sympathy with Mr. M'Crae with regard to the position of workers in gas-works. They should receive every consideration; and everything possible should be done to ease the heavy labour they had to perform. If Mr. M'Crae paid his men 7d. per hour for an eight-hour day, that was 4s. 8d. a day, which was not an exorbitant rate for gas stokers. Many received a larger rate than that. It had been the general view that, where the hours of labour had been reduced, the quantity of work performed had not been lessened in proportion. In some cases, it had even been increased—notably in the case of a firm of engineers near Manchester, who reduced their hours from nine to eight, and found that the quantity of work performed in the eight hours was absolutely more than that performed in the nine. He (Mr. Tobey) apprehended that, when the alteration was made from twelve to eight hours at the Dundee Gas-Works, the number of charges was not reduced in like proportion. If a man put in thirty charges in his twelve hours, he would like to know what number of charges he made in the eight hours. He should also like to know the quantity of coal carbonized per man.

Mr. William Carr (Altrincham) was personally much obliged to Mr. M'Crae for his paper, which was, if not the first, at all events the most humane note sounded in the Institute since its commencement. It was well that gas managers should try to realize that there was another point of view besides that of the gas manager himself. One or two illustrious members of the profession—notably Mr. Livesey—had interested themselves in the condition of the people in their gas-works; but whether these efforts were likely to be successful, he (Mr. Carr) could not say. The paper entered on the threshold of the great labour question, which was exciting a great deal of interest in the country, and would excite still more in time to come; and he (Mr. Carr) desired to carry the subject a step farther. He, like Mr. M'Crae, was not a labour candidate; nor was he a socialist. He was not even a believer in "Collectivism;" but he should like to have a little more consideration on the part of gas engineers for those who had to do the hewing and carrying. At the last meeting of the Institute, Mr. Stelfox read a paper—for which he had, he thought, very properly received the first premium and the President's Medal—in which he stated that "to produce six million cubic feet of gas with a particular form of apparatus, the service of 20 to 24 men would be required. To make this quantity of coal gas the previous season, they employed 340 stokers; and he added that, in submitting these figures to an assemblage of gas managers, comment was needless." What was the inference to be drawn from that sentence? A little later on, he said that 8 active men would be able to do the same work—meaning, of course, that it was better to use 8 men than 340. That was apart from any consideration of saving or cost. The plain inference was, wherever it was possible to reduce the number of men, and throw a number of hands out of work, it was desirable to do so. Mr. Stelfox did not say so; but that was the inference he drew. Mr. William King, of Liverpool, speaking on the subject at the meeting of the Institution of Gas Engineers last May, was reported in the Journal of Gas Lighting for May 21, to have said: "Quite independently of the economical production, came the questions of finding a market for coke, and being more or less independent of cannel proprietors, and the possible solution of the labour question. For, however amicable the relations might be between employer and employed, they would all agree that, if they could use 20 instead of 200 men, it was in every respect very much better." He (Mr. Carr) should like to know what it would be in the view of the 180 men who were turned out, and who had their wives and families thrown on their hands, with no prospect of supporting them. Mr. King opened the discussion on the paper; and he was followed by many eminent gas engineers. But, so far as he had read, they all agreed—there was no one who took the slightest exception to this most inhuman expression. Mr. Livesey was not present, and was probably too busy to read the proceedings of the Institution; and, therefore, he had not since taken exception to it. The President of the Institute, in his excellent address the previous Tuesday morning, said there were some 55,000 to 60,000 men employed in this department of work. If they could by sending money over to Russian oil merchants throw out some 40,000 men, and increase the difficulties of the unemployed question, would it be desirable to do so? Was it a thing they should consider an advantage, because it would lessen their troubles? He had heard it stated that men who had brought an industry into a community, and employed a large number of men, were benefactors of the community, because they invested their capital for the benefit of the working people of the district; and yet they were told, in cold blood, that it would be better in every respect—apart from any economical considerations, and however amicable the relations between the workers and the employers might be—to do with 20 men instead of with 200. He (Mr. Carr) thought that Mr. M'Crae had done good service by setting the example of considering the other side of the question—the stokers' side—because the gas company or the corporation depended for its success on these very people whom they were going to throw out of employ. These men were gas consumers as well as stokers; and they formed a part of that vast community which gave the gas company or corporation the power to trade and make dividends. He was very glad that some expression should go forth from the Institute that this was not the opinion of the whole of the members.

Mr. Norton H. Humphrys (Salisbury) did not think that the substitution of the eight-hour for the twelve-hour system could be universally adopted. He was quite in sympathy with every word that had been said about having due regard to the working man; and he could quite understand that in a large works the eight-hour system was an excellent one, and that it might be substituted with advantage for the twelve-hour shift. But there were works of all sorts and sizes; and it should not go forth as a universal rule that the eight-hour shift was the only right mode of working. They had different classes of workmen to deal with. He had been accustomed to work the twelve-hour system; and most small gas-works in the South-west did the same. The class of men they had to deal with were extremely slow; they did not get through anything like so much work in the twelve hours as was done in large towns in eight hours. Some time ago an advertisement was inserted in his local papers, offering gas workers a large remuneration if they would stand in on a particular occasion when help was needed in London. Two or three of their men went up and tried it; but they soon had enough of it, and came back in a week or two, and went on very contentedly with the twelve-hour system. He believed in a good rate of wages; in considering the men with regard to Sunday labour and annual holidays; and in offering a remuneration somewhat above that prevailing in the district, so as to attract a superior order of men. But to introduce the eight-hour system in place of twelve hours would be simply unnecessary in many places.

Mr. Chas. A. Craven (Dewsbury) said he was in entire sympathy with the views enunciated in the paper, and could confirm by his own experience the fact that there was very considerable benefit in reducing the hours of labour from twelve to eight a day. He thought the hours ought to be lessened not only with regard to stokers, for eight hours was quite enough for any man to work under ordinary requirements and circumstances; and he was sure that the subject would have to be considered—perhaps not all at once, but by degrees. It was often said that, if better wages were given, and more time to stokers, they would employ it in an improper way. No doubt some of them did so; but he could give his testimony to the great moral and social improvement that had taken place in the stokers he had to do with. Some 20 or 30 years ago, when the children used to come and bring the day-meals for their parents, they were clad in a very inferior way from what they were at the present time. On Saturday afternoons,

he often met his men who had been stoking during the day decently clad (and sometimes smoking a cigar); and he was very pleased to see it. They should all try to improve the status of the workmen. He was very doubtful, however, whether the consumers would cheerfully pay 1d. or 2d. per 1000 cubic feet more for their gas supply in order to arrive at these results; but they would have to be conceded sooner or later.

Mr. W. Hardie (North Shields) said he had had some experience of the change from the twelve to the eight hour system; and he certainly thought that, in large works at any rate, it ought to be done, and might easily be done with a very small increase of cost. Under the eight-hour system, the men certainly did very much better work. Still there were cases in which it might be impossible with advantage either to the consumers, the company, or the men themselves, to work these short hours. In the case of very small works, where only two or three men were employed—one on the day shift, and one on the night shift—he thought it would be more advisable to have two men, one on each shift, who were paid 5s. a day, than to have three men whose wages were cut down to a low figure, and who would not do the work so well. He must make one remark with regard to what Mr. Carr had said, because it was rather a misrepresentation of their position to suggest that they were endeavouring to cut down the number of men employed in their works. The tendency of late years, ever since the introduction of machinery, was to cut down the number of men in all manufactures; and he (Mr. Hardie) thought that it was a very just and laudable endeavour. If the number of men was reduced, the cost of production was reduced; and that was the chief object to be kept in view, provided they did not introduce what was called "sweating." He thought retort stokers who were paid about 5s. 6d. a day, with many privileges (as they were in large works), such as time-and-a-half for extra work, and two days for Sundays, and holidays in the summer, were well off; and if the number of men were reduced from 200 to 20, and still paid a reasonable living wage, they as managers were perfectly justified in doing it. Gas engineers were not called upon to take up this subject, which was going forward irrespective of what could possibly be done by them, and try to stem the tide of workmen being thrown out of employment. If they could open up new channels and employ more men, that was all right; but to keep men employed simply for the purpose of keeping them employed, when a smaller number of men could do the work equally well, was not to be considered.

Mr. J. Stelfox (Belfast) said Mr. Carr had taken the unusual course of not only discussing one of last year's papers, but also a paper read before another Society; and as he called in question the views he (Mr. Stelfox) had expressed last year, he must ask permission to say a word or two. The actual meaning of the expression quoted from his paper was simply this: They had been accustomed to a system under which a number of men—the only men in a town available to do the particular class of work—at short notice (within 24 or 48 hours, and sometimes in 6 hours) had threatened to put a stop to the manufacture. As each of these men was doing as much work as a man could do—the work being severe while it lasted—their difficulty would have been that probably they would have had to get two or three men to do imperfectly the work that was done by any one of these skilled men; and they could not certainly, even after training, expect any man to do more. The comparison which he drew was that with carburetted water gas a man was paid, not for his bone and muscle only, but for his intelligence and attention. So that, if called upon in an emergency to do three times as much work as he was asked to do in his daily task, he could well do so. On more than one occasion, he had been called down from his house, because the men would not wait until the following morning to hear what had been done by the Gas Committee. In such cases, any manager who was practically put to the torture, because for the moment the men found themselves in a position of power, could readily appreciate the great change when he felt that half-a-dozen willing men, who had the interest of the place at heart, could save them in such an emergency. He thoroughly approved of everything in Mr. M'Crae's paper, as regarded the principle of paying men handsomely and not overworking them; but the remarks of Mr. Carr would seem to tend to this—that the engineer's duty was to see what was the greatest good to be done to the stokers, forgetting that behind the stokers there was a large community by whom they as gas managers were paid to see that the community was served. If a number of men took advantage of a momentary position of power, and chose to make unreasonable demands (and they often were unreasonable), and they, in order to save the supply to a town, were obliged unwillingly to yield to these demands, they were putting the whole community under a tax which they were not willing to bear. Everything depended upon the way in which a thing was put. He was not conscious at any time of having been a taskmaster to his men; but at the same time, he preferred not to be so thoroughly in the hands of a few men who were sometimes "put up" by outsiders to make unreasonable demands, involving a complete stoppage of light to a large community.

Mr. W. W. Hutchinson (Barnsley) said he must take exception to Mr. M'Crae's statement, where he claimed to have shown that the twelve-hour system was wrong, and that it put too much pressure on the stoker. He objected to Mr. M'Crae's conclusions, and stated that there was a popular misunderstanding that the twelve-hour shift meant twelve hours' work. This was not so; for the so-called twelve-hour shift simply meant two shifts in the 24 hours. But the men were not on the works more than 10½ hours; nor did they work more than 6½ hours in the day, either at light or heavy work. He had had the work carefully timed in the past, when it was a matter of some importance to his Company; and he found, from a careful average of old experienced stokers as well as new ones, that 4¼ or 4½ hours was the fullest extent of labour, such as the public usually understood when they talked of twelve-hour stoker work. The other two hours (making 6½ hours total work, and 4 hours absolute rest) were simply light work, that any strong lad could easily do. Even some of the stokers of the present day, if they were left free from any outside influence, would themselves object to the eight-hour shift, because it would crowd out a number of stokers simply from inability to perform the eight-hour shift in the manner required. In many cases, there was nearly as much work to do in the eight hours as in the twelve; and consequently a man not quite in his prime was turned out to a lower order of work. Though he agreed with the general tenor of Mr. M'Crae's paper, and the good intention expressed by several speakers, he thought there was a great deal of well-intentioned, but quite misplaced, sympathy; and they need not trouble at all about the matter, for the gas stoker of the present day was very well able to take care of himself. He (Mr. Hutchinson) came from a place where they paid their stokers about the highest wages in the country. He took exception also to Mr. M'Crae's statement that a spirit of conciliation would often avoid the disputes which had arisen. He knew a place where this spirit of conciliation, and good treatment, and excellent wages had been tried for 25 years; but it was not a bit of use as against other advice given to them by parties who neither found them work, paid them wages, or meted out good treatment. He approved of the spirit of conciliation, and still practised it; but he regretted it did not have the effect Mr. M'Crae put so strongly forward. With regard to gas managers, he did not want to say much; but he agreed there were many cases in which the influence of the Institute ought to be used to protect the gas manager. He had no reason to complain himself. But he did notice, with great sorrow, the ridiculously low salaries offered in advertisements for certain services; and he had heard of many cases where managers had not been properly treated by town councils and other public bodies. In such cases, he thought the influence of the Institute ought to be used in a proper and careful manner to give the members timely support.

Mr. Denny Lane (Cork) was much surprised to hear the observations made by Mr. Carr with reference to the question of employing a larger number of men instead of a smaller number. He did not think anything could be more inconsistent than his conduct, because he had ascertained by minute inspection that the garments worn by Mr. Carr were woven and spun by machinery. If, however, the wool had been hand-spun, and hand looms had been employed for these purposes, there would be a very much larger number of people employed on them than at present, Therefore, nothing could be more inconsistent than for a

gentleman who, in practice, wore clothes made by machinery to object to the introduction of machinery in gas-works. It was a great mistake, if one took the whole community together, to suppose that there would be any reduction in the amount paid in wages by the introduction of machinery. If one took Lancashire and Yorkshire before the introduction of the spinning-jenny and the power-loom, there was not one person employed in these counties in the manufacture of textile fabrics for a thousand who were employed now. If it was possible to produce any article more cheaply by machinery than by hand labour, the inevitable laws of political economy would compel the manufacturer to produce that article in the way in which it could be made most cheaply. In consequence of cheap cost and low price, the consumption would increase. Here, to a certain extent, they had protection against articles manufactured in Germany. Gas, although sometimes made portable, was not quite portable enough to be brought over from Germany; but, if they carried out the system of employing the larger number of hands instead of the smaller, the effect would be that articles manufactured abroad would be imported here, and a smaller number of men would be employed than at present. It was only right to take the whole community together—the consumers and proprietors of gas-works, as well as the people who produced the gas; and then he did not think it would be any benefit to anyone to employ 200 men instead of 20. No doubt there would be a certain amount of difficulty in the transfer of men from one industry to another; but that was inevitable to all improvements.

Dr. Stevenson Macadam (Edinburgh) said that this was a point on which a scientific expert would not be held capable of giving a practical opinion; but he hoped the meeting would acknowledge that even a scientific expert might have some common sense, or what was known in the North by the term of "gumption." It appeared to him that, under the circumstances of the different sizes of gas-works, one hard-and-fast rule could not apply. In works where a large number of retorts required to be looked after, the eight-hour system might be carried out with great efficiency and advantage; whereas in the smaller class of works twelve-hour shifts would not be too hard for the men. No doubt, this subject was one which, after the expression of opinion given by so many managers, might be fairly left for any intelligent manager to decide for himself with reference to the special circumstances of his own gas-works. There was one point in the paper which he (Dr. Macadam) was very pleased to observe—showing the care which the author (and no doubt other managers) took of their men—where Mr. M'Crae referred to the desirability of having bath-rooms for the men, which they could use before leaving the works. He had occasion lately to examine into somewhat similar works (so far as the stokers were concerned) all over the kingdom—namely, the refuse destructor works employed for the destruction of the refuse of towns; and he was glad to say that in several of these works, where they were carried out with intelligence, baths were provided. It appeared to him that the introduction of baths in gas-works, to a certain extent, where the men might clean themselves and change their clothes, was a movement in the right direction, and would enable the men to leave the works not only as sensible men, but as cleanly men.

Mr. Alderman Miles (Bolton) said he rose with some diffidence to say a word or two on this subject; but he felt bound to do so for several reasons. If members would carry their minds back to the meeting at Carlisle four years ago, Mr. Charles Nickson, of Manchester, read a paper on the relations of companies and corporations with labour. At that meeting, he (Mr. Miles) stated, along with other gentlemen, that he thought if proper conciliatory measures were meted out to the men, disputes either of one kind or another might be satisfactorily bridged over. That was his opinion at the time, because he had had considerable experience in the settlement of a dispute which had just arisen at that time. He regretted that he could not speak now in so hopeful a strain. It was said that an ounce of practice was worth a ton of theory; and, unfortunately, he had since had some experience which led him to come to a somewhat different way of thinking. At the beginning of last winter, if Mr. M'Crae had had a demand from his stokers—not through the stokers themselves, but through the wonderful Association which they now had, named the Gas-Workers' Union—that all Sunday labour should be paid for double time, he thought he would have been somewhat startled. But that was their condition at Bolton; and also a demand for 10 per cent. increase in all labourers' wages. Such a demand could not be acceded to. They had for many years made it a point of being conciliatory to all their employees. They introduced some years ago the eight-hour system, and granted 5s. a day; and he was bound to say that he thought it was the right principle, and that it had worked remarkably well. But when one boon was given and another boon was given, and one kept giving them year after year, and then just at the beginning of winter a fresh demand was made, it became almost intolerable. They could not see their way to grant what was demanded; and he feared serious trouble. It was a matter of weeks' negotiation; and many hours were spent, in conjunction with the representatives of the Association, before they could come to a conclusion. They had actually to be told at last that, if something could not be done by way of mutual concession (and it was only at the last moment that it was done), they would have to resort to stoking machinery. To this the men responded that they must take their chance if it were so. While he was willing to concede that consideration should be shown to the men to the utmost, it must be acknowledged that at times they were exceedingly difficult to deal with. A case occurred to his mind where he was sent for to the works one day by the engineer on a small matter apparently to a gas manager. They had two beds of retorts with eight mouthpieces each. One of the retorts had fallen through owing to long usage; and the men were asked to put in the quantity of coals that should have gone into that into the remaining fifteen retorts. They absolutely refused to do so; and not less than 70 or 80 of the men struck work and left the retorts—the ground of their refusal being that they could not put the extra quantity in the retorts, which was an absurd statement to make. It was pointed out to them, in unmistakable language, that the work could be done, and would have to be done; and the Conspiracy and Protection of Property Act was pointed out to them. They only then reluctantly went to their work. He merely mentioned this circumstance as one of those little matters which might come under the cognizance of a gas manager any day; and although they were very anxious to be conciliatory, yet in the future there was a great deal of trouble before them with regard to the labour question. It had been said what an excellent thing it was to provide baths for the workmen. They did so at Bolton; but they were hardly ever used. In fact, they did everything they could to make the workmen as comfortable as possible; but what the workman wanted was as small an amount of work as he could get, with as large an amount of pay. While he (Mr. Miles) was saying this, he was bound to mention that this trouble did not come from the majority of workmen themselves. It was from a few men who took on themselves the position of leaders, and who were never content unless they were making some fresh demand.

Mr. T. Duxbury (Darwen) said he well remembered the Carlisle meeting and Mr. Alderman Miles's speech, which he considered at the time to be rather truckling to the workmen. That was his opinion after the experience of a strike he had had at his own works. There seemed, however, now to be a turning round in the opposite direction of both Mr. Alderman Miles and Mr. Carr. He did not quite understand the humanitarian view which had now been adopted by Mr. Carr, seeing that it was so short a time since Mr. Carr wrote a letter from Stalybridge criticizing the Halifax gas engineer's annual report, when he said that he "was not aware that the gas-works was a charitable institution," or "that the retort-house was a convalescent home." He (Mr. Duxbury) thought that the workmen were thoroughly well able to take care of themselves; and if they were faithfully treated, without truckling to them too much, they (as gas managers) would be able to get on perfectly well with them. Mr. Mr. M'Crae referred to the gas manager's position; and smarting as he (Mr. Duxbury) was under such treatment as he presumed Mr. M'Crae was referring to, he felt very strongly on the point. He had principally to complain of one man, who had been able to do more against him than the whole twenty-three others on the council could possibly prevent. He thought members of town councils should feel that, where they found the gas manager was being persecuted at times, it was the duty of the other

members of the council to protect their servant. In his own particular case—which he only mentioned as a sample—the remaining members of the town council had not cared individually to take much action in defence of their servant, who very often was precluded from defending himself. Now, when things came to their present position, the very men they had been speaking about—the stokers and labourers—turned upon the town councillors, and told them they ought to have protected the manager. This showed, at any rate, that the workmen had some common sense, and some sense of fairness even towards their manager. If they treated the men fairly and squarely, without truckling to them, they would find them perfectly well able to reason; and no one knew better than the men themselves when they were treated fairly. With respect to the paragraph in the paper about gas managers, he hoped, if it ever fell to his lot to have an opportunity, he should certainly have something to say in defence of gas managers with respect to the personal spite or splenetic action of individual members of town councils. In his case, a man got on the town council; and there was not the slightest doubt he went for one particular purpose. Some councillors did not scruple to say that no man—the town clerk, surveyor, or anyone else—ought to have more than £2 or £3 a week; and they stuck to this principle, and worked for it. He was glad to think it was not so in a large majority of town councils. The treatment referred to in the paper, did obtain in some towns; but he (Mr. Duxbury) hoped they would be fewer in future than they had been in the past.

The PRESIDENT said he had abstained from taking any part in the discussions hitherto; but seeing that Mr. M'Crae had touched on the eight-hour question, he thought it right to say that it was over twenty years since the Edinburgh Gas Company first introduced the eight-hour shift. It was brought about for two reasons. First, the twelve-hour shift was thought by the Directors at that time to be long for men to be engaged in such work; and, secondly, he thought by having an eight-hour shift, and increasing the wages, they would have a better class of workers. He was glad to say that this system had been entirely successful. It was quite a treat to see the workmen and their children—especially on Sabbath afternoons—walking about the streets clad as respectably any artizans in the city; and it had been a great pleasure to him, who had been with them so long, to see them, not only so respectful to himself, but so respectably attired. With regard to conveniences for the men, they had just completed a full set of conveniences—bath-rooms, washing places, lavatories, and everything desirable, and a dining-hall which could accommodate 70 men at one time. In fact, they might almost have Sabbath afternoon service in the hall. With regard to the treatment of gas engineers by town councils and corporations, there was no doubt a great difference in different places. Some corporations were solely composed of gentlemen who spurned the idea of doing any injury to the influence of their officials. Others seemed to have no consideration for the feelings of their officials; but he hoped these were exceptional cases.

Mr. M'CRAE, in reply, said he believed the discussion had been more valuable than the paper itself, especially as one speaker had criticized what another had said. Most of the gentlemen had spoken kindly with regard to the paper, for which he was obliged. Mr. Tobey referred to the amount of work performed by stokers. It must be understood that to reduce the hours of labour, and to increase work, would be no improvement to the men; and what he (Mr. M'Crae) wanted to see was an improvement. Therefore, he put it as two-thirds of the work and two-thirds of the hours. He could not say off-hand the number of tons of coal carbonized, because there were so many different systems employed in the works. Mr. Hutchinson spoke about the stokers working 10½ hours, which was called twelve hours; but he would observe in the paper that he (Mr. M'Crae) had dealt with this matter, and pointed out that, if the men were not actually filling and emptying retorts during the full twelve hours, their surroundings were very objectionable. They were not allowed to leave the place, on any consideration, except through illness—if they went out of the works, they must have a pass; and to talk about the exact number of hours the men were at hard work was all nonsense. They had to be there. Of course, he did not say they had all to be on exactly the same level; but how would Mr. Hutchinson himself like to be sitting down on a coke-heap to take his dinner, with all the heat, smoke, and dirt about. It was a good deal worse than charging a retort. It must be called a twelve-hour shift, if it was called anything at all. Now to deal with the gentlemen from the South. It must be quite refreshing to come from among those tumultuous people south of the Tweed to Scotland, the land of peace. Mr. Alderman Miles and his dirty stokers, and Mr. Duxbury and his cantankerous town councillors, he was happy to say they had no experience of in Scotland. They had baths at the Dundee Gas-Works, which were regularly used; and he did not see one stoker leave the place unless his face and clothes were clean. In fact, they enjoyed the baths very much; but, of course, they were cleanly people in Scotland. Mr. Hutchinson said his men would not vote for an eight-hour shift if it were offered them. His (Mr. M'Crae's) men would not go on a twelve-hour shift if they were asked. But this required some education; and they were certainly an educated race in Scotland. They had too a Conspiracy and Protection of Property Act in Scotland, which was posted up in the works; but he had never had to point to it. They were told by ministers, that if they wished to understand one verse of a chapter they must read the verses before. Mr. Miles had told them about his great strike at Bolton. But he should like to read the verse before that; and know if the engineer was quite in touch with all his men. Perhaps he had carried out the opinion which had been expressed more than once, that the stoker should take care of himself. Well, he was taking care of himself when he was going to strike. He said that gas managers should take care of a stoker as well as the works—to leave nothing undone for their comfort; to let the men feel that the manager was quite in touch with them himself; and that he was not only their master but their friend. He did not want to convert the works into a convalescent home; but he knew every man in his place, and every man knew him.

Alderman MILES said the engineer at Bolton was a Scotchman.

Mr. M'CRAE was glad to hear it, but was sorry that he had fallen into such bad company. Mr. West referred the other day to converting labour into a pastime; and many of the members laughed, and seemed to think it was a burlesque. But he (Mr. M'Crae) thought that it was a beautiful little speech. What did it mean? It meant making the labour light. Men should be treated as men, and not as if they were machines. They were not demons, but human beings like ourselves; and they should be treated as such. They would all admit that golf was a pastime; but it was hard work all the same. So in a gas-works, as Mr. Carr said, there was a human feeling which ought to come into play in all their relations with their men; and every consideration should be shown them. But, at the same time, they should not let them off with half work. He was glad to think the subject had been pretty well threshed out; and all the matters brought forward had been so amicably discussed.

MATTERS OF INTEREST IN CONNECTION WITH THE WASHING OF CRUDE COAL GAS.

By LEWIS T. WRIGHT.

In the following paper, the author proposes to review the washing or scrubbing process employed for the abstraction of ammonia from coal gas, both from the theoretical and the practical sides; to show in what manner the operation is limited in its various stages by the properties of the ammonia compounds that are produced; to give some data that may be useful to his colleagues in controlling the efficiency of the apparatus; and to present facts hitherto unnoticed that may serve to suggest improvements in the details of the operation, and help to reduce the quantity of extraneous water employed—water that serves mainly to reduce the strength of the final product, and, by increasing its bulk, adds thereby to the cost of its transportation and conversion into sulphate of ammonia.

The author believes it would be possible, in many cases, by reducing the quantity of water introduced into the gas-purifying process, to derive considerable advantage, both from the point of view of the illuminating power of the gas and also from the unnecessary bulk of gas liquor that has thereby to be dealt with. He has carefully tested in

practice all theoretical suggestions, in order to give greater security to their application, and has endeavoured to trace in the varying circumstances of practical examples the influences of the physical and chemical properties of the ammonia compounds that occur in gas liquor.

It is well known that the quantity of nitrogen—the keystone of ammonia—occurring in coal is not large, as it is also generally known that of this small quantity but a very small percentage afterwards appears in the crude coal gas as ammonia. Caking coal generally contains about 1¾ per cent. of nitrogen—rather less than more; and those coals that contain much less than that quantity (say, from 1 to 1·4 per cent.), are generally shales or cannels.

In the author's experiences, the caking coals contain from 1·56 to 1·9 per cent. of nitrogen; and of this amount they yield from 11·59 to 15·72 per cent. as ammonia on the distillation of the coal, according to the circumstances of the case. The proportion of the nitrogen so recovered is small; and yet it is important. The cannels generally contain less nitrogen, and yield less ammonia on distillation. The same coal will not always, however, give the same amount of ammonia. The author's researches* show that the formation of this body is affected by the temperature. At very low yields of gas per ton, the amount is generally lower than at moderate yields. When the make of gas is very high, there is also a diminution in the amount of ammonia.

The following tables will give some information respecting the behaviour of coals in regard to ammonia when distilled at different temperatures. The results were obtained as in practical work, and are the results of a seven days' average.

Caking Coal.		Caking Coal.		Cannel.	
Yield of Gas per Ton.	NH_3 per Ton of Coal.	Yield of Gas per Ton.	NH_3 per Ton of Coal.	Yield of Gas per Ton.	NH_3 per Ton of Coal
Cubic Feet.	Lbs.	Cubic Feet.	Lbs.	Cubic Feet.	Lbs.
7,856	6·4	7,512	6·39	7,125	5·9
8,547	6·5	9,431	7·50	7,835	6·2
11,128	5·7	10,162	7·89	9,679	5·4
..	..	11,620	7·41	10,047	5·3

There are possibly other influences at work that affect the yield of ammonia.

In order to show the proportion of nitrogen in different samples of coal, and the yields of ammonia, the following table is given of results obtained in practical working :—

Caking Coals.

Percentage of Nitrogen.		Pounds of NH_3 per Ton.		Percentage of Nitrogen found as NH_3.
1·90	..	7·42	..	14·3
1·67	..	5·47	..	12·0
1·75	..	5·97	..	12·5
1·67	..	6·29	..	13·9
1·68	..	5·79	..	12·7
1·73	..	7·42	..	15·7
1·74	..	6·43	..	13·6
1·88	..	6·29	..	12·3
1·59	..	5·79	..	12·7

Cannel Coals.

1·28	..	6·1	..	17·6
1·46	..	4·8	..	12·1
1·37	..	5·2	..	14·0
1·28	..	4·9	..	14·2

There is a class of coal that is commonly called cannel but that is not strictly speaking a cannel coal more than in name. This coal is found in different seams and is large, hard, and bright, and has the appearance of cannel. On distillation, it intumesces and cakes. It is further characterized by containing but little ash, and is therefore free from the earthy matters that are the usual characteristics of cannel. It yields about 19-candle gas, and is probably caking coal that, being free from charcoal layers and other "partings," is harder and not so easily broken.

This so-called cannel gives :

Percentage of Nitrogen.		Pounds of NH_3 per Ton.
1·7	..	7·8

And, therefore, as regards ammonia, as well as regards ash, illuminating power, and coke, it behaves more as caking coal than as cannel.

In the case of coal containing 1·7 per cent. of nitrogen (an amount which may be taken as an average for caking coals), in order to give 7 lbs. of ammonia per ton of coal, it would have to yield 15 per cent. of its nitrogen in that form. But caking coal may very well yield less ammonia even when every care has been taken to avoid loss of this valuable product. It will be assumed in this paper that the yield of ammonia is 6·8 lbs. per ton of coal. This amount is equal to 1·5 per cent. of the gas by volume, or 476 grains per 100 cubic feet in the gas as it leaves the retorts and before it commences to condense.

Accompanied with this alkali, there is a large amount of acid gases—viz., carbonic and hydro-sulphuric acids. The amount of these two acids that play so important a part in the washing process, varies much indeed according to the nature of the coal. The finest Yorkshire and Newcastle coals give the least carbonic acid. The Derbyshire Silkstone and Scotch splints give notably more, and the cannels generally very large quantities of carbonic acid. Of sulphuretted hydrogen, the cannels generally give the lowest amounts.

The following table gives the amounts of these impurities in various classes of coal :—

Impurities in Condensed but Unwashed Gas.

Class of Coal.	Carbonic Acid.		Sulphuretted Hydrogen.	
	Grains per Cubic Foot.	Volume Percentage.	Grains per Cubic Foot.	Volume Percentage.
Newcastle . . .	12	1·5	9	1·4
Yorkshire Silkstone .	12	1·5	8	1·3
Derbyshire do. .	12 to 19	1·5 to 2·3	6 to 12	1 to 2·0
Cannels	30	3·7	3 to 6	0·5 to 1·0

The quantity of both these impurities is increased when the temperature of distillation employed is increased, as will be seen in the following table :—

Caking Coal.

Yield of Gas per Ton.		Grains of CO_2 per Cubic Foot.		Grains of H_2S per Cubic Foot.
7,856	..	16·92	..	3·16
8,547	..	18·38	..	4·69
11,128	..	19·37	..	5·87

Cannel Coal.

7,853	..	32·60	..	4·80
10,047	..	39·27	..	4·97

Though the ammonia in the gas is always accompanied with more than enough acids for its saturation, yet it is not combined with these acids so long as it remains in the gaseous condition. But any water that condenses from the gas containing ammonia, or that has been otherwise in contact with such gas, and therefore also contains ammonia, will contain both carbonic and hydro-sulphuric acids, and is not a solution of free ammonia, but a solution of salts of ammonia—salts formed by the combination of this body with different proportions of the two acids in question.

As types of the class of compounds that ammonia forms under these circumstances with the two acids in question, it will suffice for the moment to consider the two carbonates—the neutral carbonate $(NH_4)_2CO_3$, in which two volumes of ammonia are found combined with one volume of carbonic acid, and the acid, or bicarbonate, in which one volume of ammonia is combined with only one volume of carbonic acid. Thus, according to the salt formed, or if both salts be formed according to the quantity of each, so will one volume of ammonia be accompanied with either half a volume or a whole volume of carbonic acid, or an amount between half a volume and one volume in the case of mixtures of the two carbonates. In the same manner, there are two similar compounds of ammonia with sulphuretted hydrogen or hydro-sulphuric acid. It will be interesting to know in what proportion the ammonia combines in practice with these two weak acids. The two acids are both called weak acids, as they are easily displaced from their combinations by stronger ones; but the sulphuretted hydrogen is by far the weaker of the two. The ammonia thus combined is technically known as "free" ammonia. This expression is quite incorrect, however convenient it may be. It, however, has become ingrafted in our technical phraseology, and serves to distinguish the ammonia that is combined with the two weak acids—carbonic and hydro-sulphuric acids—from some, and a not unimportant quantity, that is combined with stronger acids. The compounds of ammonia with carbonic and hydro-sulphuric acids are destroyed at a temperature under that of boiling water, and the ammonia that they

* See *Journal of the Society of Chemical Industry*, Vol. VII., p. 59.

contain can, in consequence, be expelled from their solutions by the simple action of boiling. But, at the same time, the liberated acid gases are also expelled; and thus if the ammonia be re-condensed in water, the carbonic and hydro-sulphuric acid also condense, just as in the original formation of the gas liquor from the gas, and the ammonia compounds are re-formed. Thus the operation of boiling does not result in the final separation of the alkali, ammonia, from its attendant acids, but only to dis-union, though owing to the somewhat greater facility with which the acid gases leave the heated solution, the proportion of acid to the ammonia can be reduced by a simple distillation and recondensation in water of the ammonia. Thus it must not be understood from the use of the term "free" ammonia that the ammonia in question is free and not combined, but only that it is united to weak acids. There is a further amount of ammonia, principally as ammonium chloride, or sal ammoniac, equal to from about one-fourth to one-fifth of the total ammonia. The chlorine that furnishes this sal ammoniac is originally contained in the coal, and in the distillation is evolved as hydrochloric acid. This body forms the "salts" that are often found mixed with tar in the hydraulic or foul mains where the temperature is high.

It will be interesting to know what volume of the acid gases in question can combine in practical conditions with ammonia. The author has investigated this subject and finds that the amount depends on the degree of concentration of the gas liquor, and the temperature at which it is formed. It will be found in practice that in gas liquor of average strength, the so-called "free" ammonia is combined in the following proportions: For every 100 volumes of ammonia there are from 60 to 70 volumes of the carbonic and hydro-sulphuric acids.

The following table will show in what manner this so-called "free" ammonia is combined:—

Strength of Liquor. Ounces Saturation.	Per 100 Volumes of Ammonia.		
	Volumes of CO_2.	Volumes of H_2S.	Volumes of $CO_2 + H_2S$.
28·0	49·0	8·0	57·0
12·0	51·5	11·3	62·8
7·5	52·4	15·3	67·7
2·7	50 0	24·0	74·0
0·2	35·0	45·0	80·0

It will be observed that the weak liquor contains decidedly more acids in proportion to the so-called "free" ammonia, than the strong liquors, but that the increase is due to the increase of the weaker acid—viz., sulphuretted hydrogen. With the ordinary strengths, there is not a notable difference in the proportion of carbonic acid, which is the impurity that is expensive to remove. It will be observed also that the amount of acids relatively to the ammonia is larger than that required by the class of compounds $(NH_4)_2CO_3$ and $(NH_4)_2S$, or those of two volumes of NH_3 to one volume of CO_2 or H_2S, but not nearly large enough for the compounds $(NH_4)HCO_3$ and $(NH_4)HS$, or those of one volume of NH_3 to one volume of CO_2 or H_2S.

The proportion of the acids varies with the temperature of the formation of the liquor. For that reason, slight differences will be found at different seasons of the year.

As regards the influence of temperature, it will be found that at a low temperature there are more acids combined with the ammonia than at a high temperature, though the difference is not very important till a temperature of about 176° Fahr. is reached. It happens, however, in gas-works that in the case of gas liquor produced, for instance, in the hydraulic main, that for every 100 volumes of the so-called free ammonia, there are only about 35 volumes of the two acids in question, of which 24 volumes will be carbonic acid and 11 volumes of sulphuretted hydrogen. Thus when such liquor is cooled and used in the scrubbers for washing the gas, the ammonia it contains is able to combine with a further 30 volumes of acid gases, of which about 20 volumes will be carbonic acid and 5 volumes will be sulphuretted hydrogen.

The composition of the liquor from the condensers having a mean temperature of condensation higher than that of the finished gas, will also exhibit the influence of high temperature in containing a low proportion of carbonic and hydro-sulphuric acids to the so-called free ammonia present. Its composition will, of course, depend upon the mean temperature at which it has been formed. This liquor, besides being able to absorb more ammonia will also be able per 100 volumes of so-called "free" ammonia originally present to add a further 10 or 15 volumes of acid gases, which will consist principally of carbonic acid. This acid, except in the case of liquors of extreme dilution, is always the predominant partner.

Since, in the final product, 100 volumes of the so-called "free" ammonia are combined with but about 65 volumes of the acids, it will be seen how, even in the case of coals yielding the lowest amount of these, the ammonia is clearly insufficient to effect the removal of more than a small part of these impurities from the gas.

Of the total volume of ammonia in the gas, which will not much exceed 1·5 per cent. in any case, one-fifth will be found in the liquor combined with the hydrochloric and other strong acids; and there will be therefore only 1·2 per cent. left for combination with the carbonic and hydro-sulphuric acids—an amount only equal to the removal of 0·6 per cent. of carbonic acid and 0·18 per cent. of sulphuretted hydrogen—quantities that appear very small in relation to the total, especially in regard to such coals as those like the Derbyshire and Scotch splint coals and cannels, giving from 1·5 to 3·7 per cent. of carbonic acid.

It is commonly stated that water at ordinary temperatures absorbs 700 times its volume of ammonia gas; but this mode of stating the case, when taken in conjunction with the operation of washing or scrubbing, is deceptive and requires qualification, as the circumstances under which water absorbs 700 times its volume of ammonia gas are not such as occur in gas manufacture.

The quantity of ammonia gas that water can absorb is dependent, among other things, on the pressure of the ammonia gas; and in order to make the common statement intelligible, it is necessary to add that water at ordinary temperatures absorbs 700 times its volume of ammonia gas when the pressure of the ammonia gas is equal to that of ordinary atmospheric pressure.

Since the quantity of ammonia in the crude gas is only 1·5 per cent. by volume, its pressure can only at the maximum be 1·5 per cent. of the total pressure of the gas, which is practically atmospheric pressure, and is therefore only equal to about 0·45 inch of mercury. The following table will show the quantity of ammonia absorbed by water at various *pressures of ammonia*, and is borrowed from Sims:—

Ammonia Absorbed by Water at Different Pressures at 68° *Fahr.*

Pressure Inches of Mercury.		Grains of Ammonia per 1 Grain of Water.
0·00	..	0·119
3·94	..	0·158
7·87	..	0·232
11·81	..	0·296
15·75	..	0·353
19·68	..	0·403
23·62	..	0·447
27·56	..	0·492
31·50	..	0·535

Not only has a solution of ammonia a tension that varies according to its strength and temperature, but the solutions of its easily dissociable compounds with carbonic and hydrosulphuric acids have in the same manner a tension of ammonia—a tension that exerts a very important influence in the operations attending the removal of ammonia from the coal gas by scrubbing or washing with gas liquor or water.

The maximum tension of ammonia gas in coal gas is only about 0·45 inch mercury; and we have consequently to deal with tensions that are too small to be shown with clearness in the above table, which is only inserted in order to show how the ordinary method of stating the case is wanting in completeness.

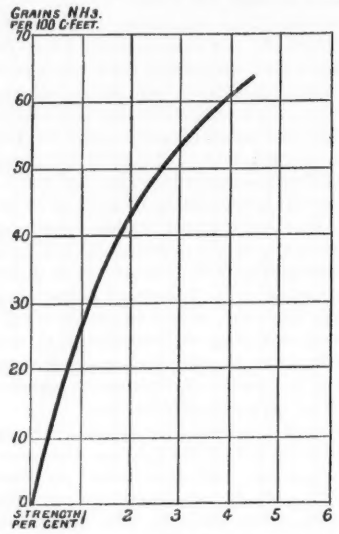
Since the ammonia tensions of gas liquor are relatively low, it is not convenient to express them in the usual way, of height of the column of mercury that balances them. It is better to state them in grains of ammonia per 100 cubic feet of coal gas.

However, since in coal gas the ammonia gas is always accompanied by an excess of acids, the liquor that condenses from the gas, or is otherwise produced, is not, as has been mentioned before, a solution of ammonia, but a solution of ammonia salts.

The major part of these ammonia salts—viz., those of ammonia with carbonic and hydro-sulphuric acids—are of an exceedingly unstable character, and in an incipient state of what is called dissociation.

The practical effect of this ready dissociability of the

ammonia compounds in question is a tendency for their solutions, such as is gas liquor, to lose the gases of which they are composed. But this loss is limited by their pressure in the atmosphere in contact with the gas liquor. Thus, just as the strength of a solution of ammonia in water is dependent upon the pressure of the ammonia gas with which it is in contact, so is the strength of the gas liquor dependent on the pressure exerted by the ammonia in the crude coal gas with which the liquor is in contact; and conversely, the pressure of the ammonia in the crude coal gas, or its proportion, is dependent on the strength of the gas liquor with which it is in intimate contact.



There is for every strength of gas liquor and for every degree of temperature (the strength in this case being on the so-called "saturation" basis) a certain pressure of ammonia that will balance its tendency to lose ammonia; and thus a gas liquor in contact with coal gas will lose ammonia (and at the same time also carbonic acid and sulphuretted hydrogen) if its quantity or pressure in the gas be less than the balancing pressure required. If, however, the pressure of ammonia in the gas be larger than that required to balance the tendency of the gas liquor to lose ammonia, then the latter will gain in strength, and abstract ammonia from the gas, until the ammonia pressure remaining balances that exerted by the liquor.

A practical example will serve to immediately illustrate this property of gas liquor. At a temperature of 60° Fahr. a gas liquor of 14 oz. strength saturation cannot reduce the ammonia in the gas it is in contact with to a lower amount than 54 grains per 100 cubic feet. (In this case it is more convenient to express the amount of ammonia on the usual basis of grains per 100 cubic feet; 54 grains is equal to nearly 0·2 per cent. by volume.)

The tension or pressure of ammonia that will balance that of any gas liquor varies with the strength of the liquor and the temperature. The tension increases with the temperature. For instance, the strength of liquor above mentioned—viz., 14 oz.—will be balanced at a temperature of 70° Fahr. by an amount of ammonia equal to about 70 grains per 100 cubic feet. Liquor of a degree of concentration so low as 1 oz. saturation exerts a degree of ammonia pressure at 60° Fahr. that is considerably over that allowed, for instance, by the London Gas Referees.

It frequently happens in practice that a portion of the scrubbing plant is used with a strength of gas liquor that at that point is not only unable to reduce the quantity of ammonia in the gas, but even serves to increase it. It must not be thought that because coal gas has been washed until it no longer has an alkaline reaction to delicate litmus paper, that the gas is thereby entirely free from ammonia. The author has found that the large proportion of acid gases present will mask the alkaline reaction of ammonia when it is present to the extent of about 2 grains per 100 cubic feet. It may be that the gas is being "scrubbed" apparently free (so far as regards the test paper) from ammonia; and this accumulates, where lime is used, as uncombined ammonia in the purifiers, and on a warm day may be given off again, thus producing a sudden rise in the ammonia impurity. It is not, as has been commonly thought, that ammonia has been synthesized in the purifiers, but that it was passing the scrubbers indistinguishable on the test-paper owing to the excess of acid gases. Theoretically, it would appear that the larger the proportion of ammonia in the gas, the easier it should be to take out a certain fraction of it. Thus, from gas containing 100 grains of ammonia per 100 cubic feet, it should be much easier to remove 10 grains than it would be to remove that amount from a gas that contained but little more than 10 grains. The chances of the water coming in contact with ammonia would be ten times as great. This is very observable in practice in the case of gas containing but very small quantities of ammonia.

This greater facility with which it is possible, in the same space and under otherwise the same circumstances, to remove ammonia of high tension, will be seen by an inspection of the table below, which is obtained from trials carried out with a mechanical washer:—

Ammonia, Grains per 100 Cub. Ft.			Cubic Feet of Gas Washed per Cubic Foot Gross Capacity of Washer per Diem.	Grains of Ammonia Removed per Cubic Foot Gross Capacity of Washer per Diem.
Inlet Gas.	Outlet Gas.	Difference Removed.		
124·0	10·0	114·0	3120	3557
136·0	7·0	129·0	1750	2257
142·0	2·3	139·7	780	1090
80·0	1·4	78·6	815	640
24·3	0·6	23·7	680	161

It will be seen that the same washing space when reducing the ammonia from 124 grains to 10 grains per 100 cubic feet could do nearly six times more work than when reducing the ammonia from 80 grains to 1·4 grains per 100 cubic feet.

The fact that the compounds of ammonia with carbonic and hydro-sulphuric acids are dissociable at ordinary temperatures, and that in consequence of this dissociability their solutions exert an appreciable ammonia tension, is, of course, the reason why it is necessary to introduce into the washing process extraneous clean water, since the natural liquor from the coal cannot remove all the ammonia from the gas, but must leave an amount equal to its ammonia tension.

A knowledge of the ammonia tensions of gas liquors of various degrees of concentration, at various temperatures, would render it possible to calculate for every case the least amount of water theoretically necessary to wash the gas clean.

To quote a case: The natural liquor from the coal is used for washing the coal gas at 60° Fahr. until its ammonia tension balances that of the gas. It is then of 14-oz. saturation strength; and the ammonia in the gas is equal to 54 grains of ammonia per 100 cubic feet. The natural liquor can now do no more work. The clean water employed to remove the remaining ammonia can be brought up to 14-oz. saturation strength, but not to any higher strength; and it is required to know what quantity of water must be employed.

Supposing that no ammonia becomes "fixed," so that all will appear in the saturation test, it will be found that the water required will be 2·54 gallons per ton of coals carbonized. Thus: The 54 grains per 100 cubic feet, if the coal is yielding 10,000 cubic feet of gas per ton carbonized, will be equal to 5400 grains of ammonia per ton; or, 0·771 lbs. 14 oz. saturation is equal to liquor containing 3·035 per cent. by weight of ammonia, supposing the liquor to have the gravity of water.

If x be the pounds of water to be employed to give the liquor of 3·035 per cent. strength, or 14 oz., we have—

$$\frac{x \times 3{\cdot}035}{100} = 0{\cdot}771; \text{ or } x = 25{\cdot}4 \text{ lbs.}$$

Thus, in such a case, it should theoretically be possible to complete the washing of the gas with about 2½ gallons of clean water per ton of coals. The average quantity employed in practice is considerably more.

It is commonly stated that the strength of gas liquor in terms of degrees of Twaddel's hydrometer can be converted into ounces by multiplying by two. The author has investigated this matter, and finds that the usual factor of two applies fairly well to the finished product, and then gives ounces distillation. For natural liquors—viz., those produced directly from the coal without the addition of any clean water—the factor of two does not apply very well; being very much too low for ounces distillation. For the liquors obtained from clean water

scrubbers and washers—liquors that do not contain much so-called fixed ammonia—the factor is too low.

Class of Liquor.	Degrees Twaddel.	Strength of Gas Liquor. Ounces.		Factor. Ounces per Degree Twaddel.	
		Saturation.	Distillation.	Saturation.	Distillation.
Natural	4·00	8·72	10·20	2·18	2·54
Do.	6·16	11·09	14·96	1·80	2·43
Do. (cannel coal)	3·88	6·52	8·63	1·68	2·22
Final product	6·30	10·20	12·60	1·62	2·00
Do.	6·45	10·80	13·20	1·68	2·04
Do.	5·25	8·30	10·10	1·59	1·92
From clean water scrubbers	4·80	—	8·81	—	1·83
	2·95	—	4·83	—	1·64

The term final or finished product is applied to the output from the gas-works as sent to the liquor works, containing the natural liquor from the coal and the clean water added for washing. Solutions of the commercial carbonate of 6° Twaddel, require to be multiplied by 2·15, and of 10° Twaddel by 2·13, to reduce them to "ounces"—in this case saturation or distillation indifferently. Solutions of sal ammoniac of about 6° Twaddel require a factor of 2·4 to convert degrees Twaddel into ounces distillation.

Discussion.

Mr. A. Dougall (Tunbridge Wells) said this was a most interesting paper, which gave the results of a very careful study of the washing of crude gas; but it did not show how they could profitably recover more of the nitrogen in the form of ammonia than at present. The author had advanced theories which explained scientifically the process of washing. These would amply repay careful study; and no doubt the paper would enable them to effect considerable economy in the use of lime. One point in which he (Mr. Dougall) was specially interested was the reduction of the quantity of clean water used. If they could recover the whole of the ammonia by the use of natural liquor and a few gallons of clean water, managers who sold their liquor would be under a great advantage, and many of those who were at present debarred from manufacturing sulphate of ammonia, because of the difficulty of getting rid of the spent liquor, would be able to evaporate the whole of it in the ash-pans, because there would be so very much less to dispose of.

Dr. Stevenson Macadam (Edinburgh) thought that the paper was likely to yield very good practical results. The reference made to the comparatively small proportion of ammonia extracted from coal in the process of distillation, and the large proportion left in the coke, naturally suggested the question as to whether there was any method by which a larger proportion of the ammonia could be extracted. He did not think it would be a loss, as Mr. Wright put it, that a larger proportion should be extracted; for, though it might bring down the price of sulphate of ammonia a little, that was not so much regulated by the amount produced as by the quantity of nitrate of soda that came into this country, and which, containing as it did a large proportion of nitrogen, could be used practically for manurial purposes in the place of sulphate of ammonia. It had been found—and he left it to practical men to devise means to carry it out—that if steam were introduced along with air into the coke from such works, a very much larger proportion of ammonia could be obtained. Experiments had been made in shale works, where the increase of ammonia was most marked. The passage of steam and air through the coke resulted in an increase sometimes of 100 per cent., and sometimes of 50 per cent. in the ammonia; and possibly some method of this kind could be introduced into gas-works, whereby a large increase in the ammonia could be obtained. With regard to the conditions in which ammonia might be present in the gas liquor, he quite agreed with the author of the paper that the most likely proportion of the ammonia to the carbonic acid was that of two volumes of ammonia to one of carbonic acid—that was the combination most likely to be formed. But, with respect to the sulphide combination, he should consider the proportion of one volume of ammonia to one of sulphuretted hydrogen was the most likely condition—not the proportion as indicated in the paper of two volumes of ammonia to one of sulphuretted hydrogen. It was recognized in chemical laboratories that the former combination was the most likely to be produced under the circumstances. He thoroughly agreed with the method of washing which had been suggested by Mr. Wright; and he thought the paper would be of great assistance, when put into practical shape, in rendering the gas more readily purified by means of the various liquors there—viz., gas liquor or clean water.

Professor Ivison Macadam (Edinburgh) drew attention to the large amount of nitrogen lost in the tar, as a point which required a little working up, and might fairly be considered when dealing with the yield of ammonia per ton. The amount of nitrogen found in tars—both in gas-works and paraffin-works tars—varied considerably. The compounds were mostly of an alkaloidal or a compound ammonia type. These compound ammonias, they had not yet been able to work up satisfactorily in the paraffin works. The loss of nitrogen from this source alone was considerable; and it required to be taken into account along with that found in the gas, when attempting to account for the whole of the nitrogen in coal.

Mr. C. S. Ellery (Bath) was not quite sure whether the point he was about to raise was made clear in the paper; but as one manufacturing sulphate of ammonia, the question had been running in his mind, whether by re-using the liquor, the result would not be to increase the quantity of fixed ammonia, so that the cost of treating the liquor in order to ultimately recover the ammonia would not be very much greater than at present. It seemed important to have as much ammonia in the free form as possible, consistent with proper washing. He thought it would be well if Mr. Wright would give some idea as to the washer used in the experiments he had referred to. They all knew that by different washers, and in different methods of using the same washer, the results obtained varied very much—at any rate, the sort of washer employed largely affected the question. If gas were first washed with strong liquor, as was his practice, and then passed through a washer with clean water—where they were not inconvenienced by the quantity of water used on the premises—the whole of the ammonia was removed, and they were spared the difficulty of dealing with what must be, under this treatment, a very large percentage of fixed ammonia in the liquor.

Mr. D. Irving (Bristol) said in this paper, as in all his work, the author had by practical experiment thoroughly substantiated what he brought forward; and they were much indebted to him for the data he had furnished. The method of washing as suggested was exactly that adopted at the Stapleton Road works of the Bristol Gas Company. The whole of the liquor produced from the hydraulic mains and the condensers, containing a large proportion of free ammonia, was afterwards used in the washers. The washer employed had a number of compartments, and a considerable quantity of carbonic acid and sulphuretted hydrogen was taken up in the manner suggested by Mr. Wright; and the fact that, in ordinary working, they succeeded in removing the whole of the ammonia with the addition of about 3 gallons of clean water per ton of coal, and kept the ammonia at the last scrubber outlet down to 0·3 or 0·4 grain per 100 cubic feet, showed that they approached very nearly to the theoretical work capable of being obtained from the 1¼ per cent. of ammonia contained in the crude gas. It would have been interesting if Mr. Wright could have made any suggestion as to how the large proportion of 85 per cent. of nitrogen in the coal could be converted into ammonia; and he (Mr. Irving) thought they would all be willing to take their chance of disposing of it profitably on the market. He should be glad if Mr. Wright would state the method employed in testing the ammonia in crude gas. He (the speaker) had found great difficulty in getting regular results, though he had taken the greatest care; and often he had to reject results, because they were apparently so unreliable.

Mr. Wright, in reply, said that Mr. Dougall was quite correct in saying that, with attention to the principles which underlay the combinations of ammonia with carbonic acid and sulphuretted hydrogen, it would be possible, by careful study, to reduce the quantity of cold water constantly employed for washing gas. He was glad to hear of Dr. Macadam's operations, because he reminded them that it was possible by methods either known or indicated to increase the amount of ammonia which coal yielded on distillation. Whether it was profitable to adopt any of those methods, he expressed no opinion. Sir Humphry Davy once said, when the duties of men coincided with their interests, they were performed with alacrity; and he

(Mr. Wright) had no doubt that, when the interests of the gas industry coincided with the duty of converting more of the nitrogen of coal into ammonia, it would be performed with alacrity. As regarded what Dr. Macadam said about nitrogen in the tar, there was no doubt that in the tar there went away from the works a great quantity of ammonia combined with the chlorine, the hydrochloric acid, and the sal ammoniac; and in the hydraulic mains, or in the inlet of the condensers, one often came across large patches of ammonia salts which were really sal ammoniac; and this sal ammoniac went down to the tar-works very often with the tar. He met an engineer the other day who said that he meant in future to be paid for this ammonia; but whether he would succeed in getting paid for it, he (Mr. Wright) did not know. The manner in which the 1½ per cent. of nitrogen usually contained in the tar was combined, had up to the present time made it unprofitable to recover it. As regarded Mr. Ellery's question, whether the re-use of ammoniacal liquor as in the Hills and Claus washing processes would increase the fixed ammonia, he (Mr. Wright) must say it did somewhat; but not to any extent which would render these processes unprofitable if they were convenient on other grounds. Unquestionably, in the cooling and repeated re-distillation of gas liquor as employed in the Hills, Claus, and similar purification processes, there was a gradual growth of fixed ammonia in the liquor. With regard to the large proportion of nitrogen which was not recovered on distillation, some was left in the coke, and some went in the tar. He thought he might answer Mr. Irving's question with regard to the quantity of nitrogen in replying to Dr. Macadam's remarks. That gentleman told them, and he quite agreed, that one would suppose theoretically that the compound formed between the ammonia and carbonic acid would be as two volumes to one; but he also said that, as regarded the sulphur compounds, he should expect to find in both one volume of ammonia with one volume of sulphuretted hydrogen. If Dr. Macadam would look at the fifth table in the paper, he would see that, in the case of weak liquors, that tended to be the case—carbonic acid was the stronger acid of the two. But when the liquor was extremely dilute, the carbonic acid did not tend to displace the sulphuretted hydrogen to the same extent as in a stronger liquor; and, consequently, in weak liquor there was a larger quantity relatively of sulphuretted hydrogen combined with the ammonia.

Title and Index to Vol. LXV.—The title-page and index to Vol. LXV. of the JOURNAL (January to June, 1895) will be ready in a few days; and, as usual, a copy will be forwarded post free by the Publisher, on receipt of a post-card from any Subscriber.

The Examinations in Gas Manufacture.—In addition to the successful candidates at the above examinations whose names were given in the JOURNAL last week, we learn that Mr. F. West, son of Mr. John West, of Manchester, passed first class in the "Honours" grade.

The Management of the Rotherham Water-Works.—The Borough Surveyor of Rotherham (Mr. Jennings) has been appointed temporary Manager of the Water Department until the parliamentary work in which the Corporation are engaged is ended. It may be remembered that Mr. C. B. Newton formerly held the dual position of Gas and Water Engineer, and that on his removal to Carlisle, Mr. M. Murdoch was placed in charge of the gas-works—the management of the Water Department remaining open.

Death of Ex-Bailie Ure, of Glasgow.—Ex-Bailie Ure, who for a number of years had been Convener of the Gas Commissioners of the Glasgow Town Council, died last Friday afternoon. He had been in failing health for some time; and was for several weeks last autumn unable to attend to his duties. As Convener of the Gas Committee, he had the largest gas undertaking in Scotland under his supervision; and his control of it was of the most enlightened description. Since his appointment, the gas-works have been almost entirely remodelled, the largest gasholder in Scotland has been erected, and another of almost the same size is under construction.

The Metrical System for England.—A Committee of the House of Commons have lately been considering whether any changes in the present system of weights and measures should be adopted in this country; and they have agreed to a report which concludes with the following recommendations: (1) That the metrical system of weights and measures be at once legalized for all purposes; (2) that, after a lapse of two years, the metrical system be rendered compulsory by Act of Parliament; (3) that the metrical system be taught in all public elementary schools as a necessary and integral part of arithmetic, and that decimals be introduced at an earlier period of the school *curriculum* than is the case at present.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 100.)

THE general position of affairs on the Stock Exchange last week showed hardly any change whatever from that of the week preceding; and there was no perceptible increase in activity, except in the mining department, where things moved briskly. But, in spite of the prevailing quietude, nearly everything was firm, and prices for the most part improved. This was specially noticeable among the high-class investment securities, which have now reached prices hitherto undreamt of. To account for this feature, one has only to look at the enormous and increasing volume of money which does not find employment in the market, and which must go somewhere, even if Consols rise to 110. Among the high-class securities Water stocks have long ranked; and now Gas stocks are slowly, but steadily, improving their position, and leaving the 5 per cent. security mark (which used to be their station) far in the rear. During the past week, numerous and considerable advances in quotation have been effected, as will be apparent upon reference to the list on p. 100. Business, too, was much more active in response to a free demand. Gaslight issues were especially busy. The "A" opened, with a flourish, at an advanced quotation. But it never could beat the closing mark of the previous week; and, after a good run of animated dealing, it fell back to the old figures. The secured issues very naturally were in good request while money was abundant, and particularly the debenture stocks; some good rises being scored. South Metropolitans were in demand, and not even the prices wanted could frighten off buyers—the "B" changing hands on Friday at 303¾. Commercials, after being long crushed, were allowed to get up. The fact that the new stock was done on Tuesday at 220, and on Friday at 230, will illustrate how much suppressed elasticity there is in them. Scarcely anything was done in Suburbans and Provincials; but British advanced again. Continentals were firm and unchanged. Several of the remoter undertakings shared in the improvement, among which were Buenos Ayres, San Paulo, Sydney, and Melbourne. The Water Companies made further progress with their recovery; and a few quotations rose freely.

The daily operations were: The Gas Market opened strong and lively; prices being very buoyant. South Metropolitan "B" and debenture rose 3 each; Gaslight "A," 2; and Melbourne, 1. In Water, Chelsea, East London, and ditto debenture gained 2 each. Tuesday was less active; but prices still rose. Commercial debenture improved 4; British, ¼; and Buenos Ayres, ¼. In Water, New River rose 5; and Chelsea, 3. The improvement proceeded gaily on Wednesday. Commercial new rose 5; ditto old, 2; and Gaslight "H," 2; but ditto "A" fell 1. Business on Thursday was active again; but changes were fewer. Gaslight 6 per cent. debenture rose 4; and San Paulo, ½. Transactions kept up well on Friday; and Commercial Gas new rose 3. In Water, East London relapsed 2. Saturday was more than usually active, and prices were good. Gaslight 4 per cent. debenture rose 1; but ditto "A" fell 1.

ELECTRIC LIGHTING MEMORANDA.

Fires at London Electric Light Stations—The Accounts of Metropolitan Electric Supply Undertakings—The Central London Railway Scheme.

As might be supposed, the frequent and disastrous fires that illuminate so luridly the career of the central station electric lighting undertakings of the Metropolis, give rise to melancholy reflections in the English electrical periodicals. The *Electrician* remarks that "the year 1895 seems destined to be written in letters of fire in the annals of electric lighting in London." Early in the year, the Kensington Court station of the Kensington and Knightsbridge Company was the scene of a serious fire; and the recent destruction of the Sardinia Street Station of the Metropolitan Company was a far graver affair. Our contemporary hopes "that these two disasters will bear fruit in more elaborate structural and mechanical precautions against fire;" but as the aspiration was accompanied by the remark that the cause of the fire remained unknown, it is open to be observed that until people know exactly where danger exists, it is impossible to effectually prevent or guard against it. Rumour has it that the switchboard was the origin of the fire; but as to whether there was a short circuit on the switchboard, or whether anything went wrong behind it, nobody has yet supplied reliable intelligence. Sardinia Street was the station which the Directors of the Company had fitted up complete with Westinghouse plant, made in America; and we shall be curious to learn whether the new machinery required to replace that destroyed by fire will be bought at the same shop, or designed upon the same plan. No public intimation was ever made as to the opinion formed by the Directors from their experience of the American plant; but engineering visitors to the station were not at a loss for a decision on the whole outfit, though for more reasons than one they may not have been able to express their views upon the spot.

The accounts of the London and provincial gas companies do

not in all cases supply material upon which an exact comparison of the condition and working of different undertakings can be based; but these accounts are clearness and fulness in a high degree compared with those relating to contemporaneous electric lighting undertakings. The *Electrician*, in its issue for the 28th ult., published what purported to be tables showing the total capital outlay and receipts and expenditure for 1894 of the statutory electric supply undertakings of the Metropolis; but in commenting upon these tables, which give evidence of the greatest care having been bestowed upon their compilation, our contemporary was obliged to confess that their preparation gave abundant illustration of the unreliability of statistics, unless most carefully sifted, as a satisfactory basis for exact argument. Nevertheless, the tables supply some useful information in regard to the state of the electric supply industry in London. Thus it appears that the total capital outlay of London Companies stood at the end of the past year at £3,900,000, which was an increase after the rate of 11 per cent. for the year. Their revenue amounted to £370,000 in round figures—an increase of 30 per cent. on the corresponding figure for 1893. The total expenditure on revenue account only rose 22 per cent. It is remarked that the figures would be considerably improved if the entries relating to the unfortunate London Electric Supply Corporation were eliminated. These, of course, contribute a sadly disturbing element in any comprehensive statement of the finances of the London electric lighting industry. It is a hopeless task to attempt to deduce from the figures relating to the different companies any safe argument for or against their prospects. Even in respect of such a simple matter as coal consumption, or rather cost of coal per unit generated, the differences between the workings of the various undertakings are enormous. Thus the Westminster Company, who stand best in this respect, generate the unit at a cost of 0·63d. for coal, while the Metropolitan Company spend 2·11d. for the same result. Leaving out the Deptford concern, the capital expenditure divided by the number of units sold for the year ranges from a little over 3s. to 12s. If it should ever come to be a question of transferring any or all these undertakings to a public authority, the great heart of Westminster would beat high for joy over the valuations.

It would appear that the Central London Railway scheme has been successfully floated; so that the electricians will have one more opportunity of showing what they can do in the way of rapid underground transit. It is a big affair; the railway comprising a double line, in separate tunnels, to be constructed after the Greathead system, from Shepherd's Bush, along the route of Oxford Street and Holborn to Liverpool Street. The route is, of course, the finest imaginable for traffic prospects; and many schemes for the making of an underground railway along the same line, to be worked by steam, have been proposed London, however, does not want any more metropolitan railways of the kind already in existence; which are eminent examples at once of technical triumph and administrative fatuity. The deeply-buried Greathead tunnels, with their comparatively nnocuous electrically-driven trains, represent a new departure in railway enterprise, which should have the most extended trial permitted by the good grace of enterprising investors. It was curious to note how, when the prospectus of the Central London Railway came out, every journalistic reference made to the venture was strictly guarded in tone, so far as the financial prospects of the line were concerned. Nobody doubted that the railway could be constructed and worked according to the selected plans; but whether the Company will pay a dividend was, and is, a very open question. The prospectus itself was very modest in its claims in this regard; anticipating from the carrying of 7 million passengers per mile per annum no more profit than would suffice to pay 4 per cent. debenture interest and 5 per cent. on the share capital, with a margin of 1 per cent. for contingencies. There is no obvious reason why these aspirations, or something not very different, should not be realized. The Metropolitan Railway paid very well so long as it was what its name implies, and only ran from Paddington to Moorgate Street. The Central London Directors disclaim a policy of extension; and so long as they keep this guiding principle in view, steadfastly following Wolsey's advice on the subject of ambition, while doing their best for the public, they will at least enjoy the satisfaction of deserving success. At any rate, the new line will find employment for a good many electricians, which is badly wanted.

The Sale and Burning of Mineral Oils.—It may be remembered that a Committee of the House of Commons last year inquired into the law relating to petroleum, and the precautions to be taken to prevent the sale of dangerous oil-lamps. At the request of the Committee, a number of experiments with lamps of various kinds were made by the Chief Officer of the Public Control Department of the London County Council (Mr. A. Spencer), as mentioned in the JOURNAL for Feb. 19 last; and the results were submitted to Parliament. It is acknowledged that dangerous lamps are largely used; but the Council have no power to prohibit their sale. It has been thought advisable to re-appoint the Committee, with instructions to give this matter special attention. The Home Department have, we believe, agreed to this; but the constitution of the Committee is uncertain in view of the recent change of Government.

GROVES AND THORP'S "CHEMICAL TECHNOLOGY."*

THE appearance of the second volume of Groves and Thorp's well-known work demands appreciative notice at our hands. While not so closely connected with the special industry represented by the JOURNAL as will be the next volume, now in course of preparation under the collaboration of Mr. Charles Hunt, Dr. Garnett, Mr. Boverton Redwood, and Mr. W. J. Dibdin, it deals with a variety of subjects upon which our readers require to be well informed. Lighting by means of candles, oils, or fatty materials constitutes, indeed, a study of vast interest for all who may be concerned with the promotion of lighting by any other means, inasmuch as these are at once the oldest, simplest, and still most generally used means of illumination; and it is the first condition of success, in popularizing other means of attaining the same end, to know all there is to be learnt about the technical history of candles, lamps, and burning oils. The volume now before us claims to supply this desirable information in new, complete, and authoritative form. According to the preface, the Editors have set themselves to deal in it exclusively with the special application of fuel to the purpose of producing light, irrespective of the heat developed at the same time; and in order to do this most effectively, something in the nature of historical or chronological succession has been adopted as a matter of convenience. This arrangement, however, has been followed only in relation to the sequence in which the various methods of obtaining light came into use; for it is evident that as the means of illumination referred to—in their higher developments, at all events—are every one of them still in use, there is no reason to suppose that any of them will be regarded as in danger of becoming obsolete. In regard to the section on "Oils and Fats," written by Mr. W. Y. Dent, in which only those used for lighting are considered, it is remarked that, although the general outline of the technology of these substances remains essentially the same as it was in early times, yet the great progress which has been made in recent years in the machinery used in their extraction and preparation, will doubtless continue; resulting in saving both in cost and in labour, besides improving the purity of the product. This observation illustrates the attitude of the Editors, who are manifestly desirous of warning students against the idea that the chapter of history which deals with any one of the lighting agents treated of in the book can safely be regarded as closed, although it may be traced back to the earliest records of our civilization.

Take, for example, the candle. The question as to whether the lamp or the candle was the earlier attempt of man to render himself partially independent of natural light, may be determined by the answer to the yet unsolved problem of the place of origin of the human race. If this happened in a temperate or northern climate, then the candle suggests itself as an improvement which was made in the course of the ages upon the brand snatched blazing from the wood fire; but if man started his inventive career in the tropics, then the oil-lamp was his more natural improvement upon the torch. As the Editors remark, the candle has remained essentially the same throughout the ages, although the materials of which it is composed, and the machinery for making it, have varied very considerably. And the candle trade of to-day has to meet a large and increasing demand.

Petroleum, the Editors think, is perhaps the most formidable rival of the candle; and they warmly commend the great care and thoroughness with which Mr. Boverton Redwood has dealt with its technology. As to the popularity of petroleum as an illuminant, the Editors declare that it "is, and perhaps will remain, in possession of the field outside towns and the larger villages. Where houses are so scattered that gas or electricity cannot well be supplied, it furnishes the main source of light, and, with the lamps now available, leaves very little to desire either on the ground of cost, health, or safety. The aggregate use thus secured is necessarily very large; and to this must be added what is employed in towns by the poorer classes, not to mention those who prefer it to gas as being more cleanly and less destructive to furniture and decorations, and on this account are willing to forego the conveniences afforded by the use of gas." With all this we are disposed to agree, with reservation of the point of the superior cleanliness of petroleum to gas. Petroleum has lightened the darkness in which dwellers in solitary and country places lived before its advent; and there is no disputing the large use that is made of lamps for reasons of taste. But the petroleum lamp may be, and often is, a very great offender against the canons of cleanliness.

The Editors confess that, in face of the controversy in regard to the flashing-point of mineral oil, they have judged it prudent to preserve silence on the point; contenting themselves with the safe observation that, whatever may be the merits of the question, "it is a distinct advantage to have a lamp so constructed as to prevent access of flame to the interior of the

* Chemical Technology; or, Chemistry in its Applications to Arts and Manufactures." Vol. II. Lighting. (Fats and Oils, by W. Y. Dent; Stearine Industry, by J. M'Arthur; Candle Manufacture, by L. and F. A. Field; the Petroleum Industry, and Lamps, by Boverton Redwood; Miners' Safety Lamps, by Boverton Redwood and D. A. Louis.) London: J. and A. Churchill; 1895.

reservoir, and that the latter should be metallic, and of such a character that, if it be thrown down or inverted, the oil cannot escape." Upon the subject of oil gas, the Editors remark that this is a curious instance of revival. In the early days of gas making, it was used to a considerable extent; and it is now again brought forward for the special purpose of lighting railway carriages and to some extent lighthouses—in both cases because it gives a light of high intensity with a small volume of gas. It ought to be borne in mind, however, that the primitive oil gas referred to here was made from animal or vegetable oils, and the manufacture was only changed to that of coal gas, or rather cannel gas, on account of the high cost and scarcity of the former substances. The high-power cannel gas of Edinburgh and other Scottish towns is, in fact, a representative of the old oil gas, rather than of the more modern coal gas.

So much for the preface, to which, on account of the nature of the volume, as consisting of a collection of writings of various authors only bound together by this common tie, it is right to pay particular attention. Following the preface is a short introductory chapter, likewise attributable to the Editors, and equally deserving of careful reading. Here we find it laid down that, with certain small exceptions, reserved for after-treatment, "the subject of lighting may be considered under two principal heads, one of which deals with the use of fuel to produce a gas which, on reacting chemically with another gas, will produce a temperature so high as to emit light; and the other in which fuel is used directly or indirectly to raise the temperature of a solid refractory body to incandescence." It will be convenient here to notice the peculiar sense in which the Editors understand and employ the word "lighting." What they mean by the term here is nothing more nor less than the production of light. In a sense, of course, to produce light is synonymous with lighting; but we venture to make a protest against the adoption of this sense as anything more than a short and, for the Editors' purpose, convenient form of expression. The word "lighting" may, in a particular connection, signify the production of light. But it has another and a totally different meaning, which is that of using the light; and we cannot afford to sacrifice this meaning temporarily to serve the convenience of the chemical technologist, without at least letting him know that it is a sacrifice. The purist in language might even go so far as to accuse Messrs. Groves and Thorp of having given their second volume a title which is a misnomer. But what they have done they have done; and all we desire to do in this connection is to warn the student of lighting, properly so called, of the sense in which the word is employed in their title.

Yet the Editors are not wholly oblivious of the second meaning of their title; for they conclude their introductory chapter with a couple of paragraphs treating very briefly of the use of lights, or artificial lighting. They first discuss what goes on in a burning candle or lamp. The candle is described as, on a small scale, first an oil factory, and secondly a gas-works, with the wick as the sole representative of mechanism. The oil-lamp is also a gas-works, not always needing a wick. "These operations, which occur simultaneously and on a minute scale in the candle, may be separated, both in time and space, and conducted on a scale of any desired magnitude, and with apparatus of greater or less complexity, as when a liquid fuel is obtained from a solid, or a gas is produced from a solid or liquid fuel, and stored until it is required for use." Water-gas manufacture is described as analogous in operation and results; but the example of the action of a mixture of nitric oxide with the vapour of bisulphide of carbon, which when inflamed yields an extremely brilliant light, is cited to show that the stages of oil and gas making are absent or of an entirely different character from the case of the candle. The Welsbach light and the electric light in both kinds are duly mentioned; and then the Editors say what they have in mind in regard to the application of lights to lighting.

This, as already observed, is not much, though what there is is to the point. Thus we are informed that "the light of the highest intensity is not necessarily the most useful;" and also that "the selection of a source of light will depend chiefly on whether it is desired that the light itself should be seen, or whether it should be the means of rendering visible objects which are not themselves luminous." For the former purpose it is declared that "the more intense the light, and the more nearly it approaches to a true point, the better"—a dictum that would certainly fail to command the support of Mr. J. R. Wigham. "When, however, light is required for the purpose of being reflected from non-luminous objects, and so rendering them visible to the eye, it is desirable to have a large amount of light of low intensity, and generally that it should be distributed about the area to be lighted rather than concentrated at one or a few points. A room which would be well lighted by means of twenty candles will be but poorly lighted by means of a single lamp giving light equal to twenty candles. Moreover, if the flame of such a lamp be surrounded by an opal globe, or a white or opal shade and cup, it will be found that the room is better lighted than by the naked flame, although in all probability the globe or shade will intercept one-half of the light." It is not not to be accepted as following upon this rule that there is any positive advantage in producing a large amount of light merely in order to destroy half of its useful effect by means of a semi-opaque globe. With the following conclusion, however, it is possible to fully agree: "Generally, it may be said that, with a given amount of light, the lower and the more uniform the intensity, the better the illumination." The reason assigned for this is physiological, and has to do with the structure of the eye. The aperture of the iris is adjusted "not to the total amount of light entering the eye, but to the intensity of the brightest spot of the image on the retina; so that while this can be seen perfectly, the aperture will be too small to allow sufficient light to enter to admit of clear vision of the remainder. If the illumination be uniform—that is, free from points of exceptional intensity—the amount of light allowed to enter the eye will be at a maximum." This statement, at all events, is very clear.

We have devoted so much space to the observations of the Editors that there is none left for affording due recognition of the work of the sectional authors, which must therefore be left for another article. A work of this interest and technical value does not appear every week; and it is impossible, in a curt review, to do justice to the writers and the Editors.

THE PORTSMOUTH CORPORATION AND THE WATER-WORKS.

The spasmodic negotiations set on foot by the Portsmouth Corporation with the view of acquiring the highly-successful undertaking of the Portsmouth Water Company are now again engaging local attention; and the outcome, if outcome there is to be, will necessarily be looked for with keen interest outside the limits of Portsmouth itself. The local press is devoting space to the subject; and, judging from a recent article in the *Portsmouth Times*, there seems to be a likelihood of local ratepayers reckoning their chickens some time before they actually crack the shell. "From inquiries which we have made," says the local organ, "we do not believe that the most ardent advocates of the acquisition of the water-works would be prepared to proceed with the gigantic financial operation unless the period for repayment were extended." This entirely confirms the view more than once expressed in the Journal as to the attitude of provincial corporations which as yet are not suppliers of water. To make good the capital raised for the purposes of such a purchase within the span of sixty years, seems to such local authorities a hopeless undertaking. Nevertheless, there is the rule of law, as prescribed by the Public Health Act, 1875, and also the rule of Parliament, as laid down in the Standing Orders. The principle thus established cannot be lightly brushed aside to suit this or that particular community. So long as the general rule remains, it must be followed, unless such special circumstances can be shown as would induce the Legislature to say that the period may justly and reasonably be enlarged. But if all corporations require an exception made to the rule (and that is what it looks like), obviously there must be general legislation to correct the position and convert the exceptions into a new general rule. Otherwise Parliament would simply stultify itself by listening to the clamour of our new race of "municipal statesmen."

There is, says the *Portsmouth Times*, a recent precedent which strengthens the belief that the desired extension could be obtained. Then it turns out that the Sheffield case, upon the special features of which we commented not long ago, is the precedent on which the Portsmouth Corporation build their hopes. This, then, is the way in which they "reckon the chickens before they are hatched;" for, argues our provincial contemporary, Sheffield succeeded in getting the Standing Orders suspended, and the period for repayment extended to eighty years, and "what Sheffield accomplished Portsmouth ought not to find impossible." That, however, is a very dangerous and misleading sort of argument. The circumstances in the Sheffield case were quite exceptional. The Portsmouth case is by no means on all-fours with it. Moreover, though, in regard to Sheffield, Parliament sanctioned an exception to its general rule, Mr. Leonard Courtney, whose authority on the policy and usage regulating such matters cannot be questioned, made an earnest protest even against the encroachment then permitted, and expressly warned all whom it might concern not to calculate on receiving similar indulgence in future. This is a feature of the position to which the Journal has more than once referred, but which it seems advisable to mention again, in consequence of the fallacious reasoning that seems likely to lead the Portsmouth Corporation into deep waters.

Meanwhile, this dilatory body stand by and see the prosperity of the local Company increasing by "leaps and bounds." Since the Municipal Committee reported in August, 1893—nearly two years ago—the Company's revenue has increased by about £1200 per annum. If the Committee again rest on their oars, there will doubtless be a proportionate increase of revenue before they rub their eyes and report again—say, in August, 1897. Already they have to face the manipulation of big figures. The statutory dividends on the several classes of shares amounted in 1893 to £27,450 per annum; and to produce a similar amount by dividend on 3 per cent. stock would require, at its nominal value, £915,000. The mortgage debenture debt of the Company was £101,250 on March 31, 1893. That debt, of course, the purchasers would have to take over, and pay off as the debentures fell due. Compensation for the Directors and officers of the Company would absorb, according to the 1893

estimate, £14,000. In fact, when last the local Committee faced the question, it was reckoned that, for all purposes, stock amounting to about £1,036,000 would have to be created, requiring a dividend of £31,080. Unless, therefore, the period of repayment can be extended, the required dividend will exceed the income. Hence the eagerness of the Portsmouth Corporation to be aided by the Sheffield precedent. If they can get the term fixed at 80 years, the amount required for interest and redemption of principal would be £34,306 14s. 2d. If they are allowed 100 years—a wildly remote contingency—the income required would be £32,785 1s. 8d.; and even allowing for the estimated saving in Directors' fees, and so forth, the income, on the basis of the 1893 accounts, works out at no more than £32,280. Obviously, therefore, the Portsmouth Corporation have a hard nut to crack; and the longer they postpone the effort to accomplish the task, the harder they will find it.

Institution of Civil Engineers.—The Council of the Institution have re-appointed Dr. William Pole, F.R.S., Honorary Secretary; and Mr. James Forrest, Secretary—an office he has filled for the past 39 years. The Institution now contains 19 honorary members, 1873 members, 3726 associate members, 351 associates, and 816 students; making a total of 6785. The new premises in Great George Street are making good progress.

The Physical Properties of Acetylene.—M. Villard has recently dealt with this subject in the *Comptes Rendus*. He says the melting-point of acetylene is − 81° C.; and it solidifies by evaporation in the open air. The crystals of solid acetylene, like those of carbonic acid, are absolutely without action upon polarized light. The solubility of the gas has been determined at 0° under the pressure of 4·65 atmospheres; and, under these conditions, the coefficient of solubility is 1·6.

Incandescent Gas Lighting for Winchester.—The persistent efforts of Mr. F. G. Dexter, the Manager of the Winchester Gas and Water Company, to remove what he rightly termed, at the last meeting of the South-West Association of Gas Managers, "the standing disgrace of the ancient city"—*i.e.*, the lighting of the streets of Winchester by oil-lamps—has at length been crowned with success; the Corporation having accepted the conditions of a contract for three years to light the entire city with the incandescent (Welsbach) gas-burners.

Society of Arts.—The Council of this Society have awarded a silver medal to Professor Vivian B. Lewes, F.I.C., F.C.S., for his paper on "The Commercial Synthesis of Illuminating Hydrocarbons," read at the meeting of the Society on Jan. 16 last, and given in the JOURNAL on the following Tuesday. In their annual report, the Council refer to the method of producing acetylene gas from calcic carbide, which was so ably described by Professor Lewes on the above-mentioned occasion as an invention which is likely to have a far-reaching effect on the gas industry. The Council also allude to the course of Cantor Lectures delivered by him on "Modern Developments in Explosives," in which, they remark, he gave a clear and popular account of the great advances made of late years in explosives. The subject had not previously been dealt with in a Cantor course; and Professor Lewes's treatment of it was much appreciated by an audience which included several of the chief authorities on the matter. Another interesting course was delivered by Professor Silvanus P. Thompson, on "The Arc Light," wherein he reviewed the most recent researches into the physics and optics of the electric arc, and described in their most important details, the latest arrangements of mechanism employed in its production.

Society of Engineers.—Last Wednesday, a party of members of this Society, accompanied by the President (Mr. W. G. Peirce), paid a visit to Dover, for the purpose of inspecting the outer harbour extension works, the existing harbour, and the station of the Electricity Supply Company. The electric lighting works comprise an engine-room containing the main engines and dynamos, which are at present one 50-kilowatt, one 75-kilowatt, and two 100-kilowatt Mordey alternators, each coupled direct to vertical compound condensing engines. There is at present provision on the circuit-board for six circuits, two of which are for the control of public arc lamps, and the remainder for the private lighting. Situated on one side of the engine-room are two continuous current dynamos, coupled direct to vertical compound tandem engines. The engine-room also contains two Tangyes centrifugal pumps, coupled direct to vertical engines, which draw water from the River Dour at a point about 100 yards distance, for use in the condensers, one of which is attached to each of the main engines. The boiler-room now contains two Babcock and Wilcox boilers, each of 200-horse power, working at 150 lbs. pressure, with space and foundations for five more of the same size. The engine and boiler rooms are lighted and ventilated from the roof, so as to avoid side windows, and thus reduce any sound to a minimum. The current leaves the station at a pressure of 2000 volts, and is conveyed, by concentric cables, to about eighteen transformer street-boxes in various parts of the town, where it is converted to a pressure of 100 volts, at which it is distributed to the consumers' premises. There are in the streets at present 21 public arc lamps, each of 2000 nominal candle power; and 10 additional lamps have been contracted for, to be suspended from arches.

NOTES.

Lord Rayleigh on Argon.

In his lecture on "Argon" delivered before the Royal Institution, and recently published, Lord Rayleigh describes fully the methods by which the newly-discovered gas was obtained, and the results of the various examinations that have been made of it. Upon the question as to whether argon is really a new gas at all, which has been raised in various technical journals, Lord Rayleigh definitely replies that the spectrum alone is enough to establish the fact. The next question is whether it is in the atmosphere; and Lord Rayleigh answers it in the affirmative for several reasons. In the first place, he argues that, if argon be not in the atmosphere, the original discrepancy of densities which formed the starting-point of the investigation remains unexplained; and the discovery of the new gas has been made upon a false clue. Passing over this, there is the evidence of the blank experiments, in which nitrogen originally derived from chemical sources was treated exactly as atmospheric nitrogen was treated. In the one case, about 1 per cent. of argon is obtained; in the other, a trace of it is found, which is attributable to the water used in manipulation. Another wholly distinct argument is founded upon the method of diffusion introduced by Graham. Graham showed that if a mixture of gases is passed through porous tubes, the composition becomes altered by the quicker escape through the pores of the lighter constituents. In Lord Rayleigh's experiment, eight clay tobacco-pipe stems were joined together by india-rubber junctions, and enclosed in a vacuum. Atmospheric air was aspirated through these pipes so slowly that the remainder collected was only some 2 per cent. of that which leaked through the porosities. If nitrogen is prepared from this residue, a gas is obtained heavier than ordinary atmospheric nitrogen—a result which proves that the ordinary nitrogen of the atmosphere is not a simple body, but is capable of being divided into parts by so common an agent as the tobacco-pipe.

Moissan on Willson's Calcium Carbide.

M. Moissan, whose experiments with the electric furnace are well known, writes to the *Revue Générale des Sciences* to dispute the claim of Mr. Willson to priority for the commercial preparation of carbide of calcium by the same agency. M. Moissan states that his first research in an electric reverberating furnace with moveable electrodes, was published in the *Comptes Rendus* of Dec. 12, 1892. In the first note, he demonstrated the reduction by carbon, under the action of the electric arc, of oxides previously regarded as incapable of reduction. He referred principally to the reduction of the oxides of uranium, manganese, and chromium; but he also mentioned the accidental formation of calcium carbide by the action of vapours of calcium—the furnace being made of quicklime—upon the carbon electrodes. Mr. Willson's American patent is dated Feb. 21, 1893, and is for the electric reduction of refractory metallic compounds. M. Moissan refrains from discussing the form of the Willson furnace, which reminds him of the Cowles and Grabau furnaces. He asserts that Mr. Willson has not in his furnace separated the calorific action of the arc from its electrolytic action. M. Moissan further declares that, whereas at first Mr. Willson regarded the formation of calcium carbide in his furnace as due to electrolytic action, in his later application for a German patent he affirms that it is a simple process of fusion. But M. Moissan's gravest impeachment of the Willson carbide of calcium process is, however, with reference to the question whether the products of reduction are obtained in the electric furnace in the fluid form or in that of powder. In the first Willson patent specification, it is insisted upon that sufficient carbon shall be employed to prevent the formation of a molten bath. Under this condition, M. Moissan declares that it is impossible to obtain titanium, which Mr. Willson claims to have prepared. Finally, M. Moissan remarks that, in a patent treating particularly of alloys of aluminium and magnesium, the claim respecting calcium carbide and other products appears to him to be exaggerated, and to be merely a conventional covering phrase without value from the point of view of priority of discovery.

The Crystallization of Iron.

In the course of a research with high microscopical powers on the micro-crystalline structure of large masses of wrought iron, Mr. Thomas Andrews has discovered certain novel metallurgical facts which may eventually contain a solution of some of the mysteries occasionally observed in the behaviour of pieces of the metal under stress. When large masses, several tons in weight, of practically pure wrought iron were allowed to cool slowly from a white heat, a secondary or subcrystallization of the metallic iron occurred. The normal primary crystals of the iron, or those which have hitherto been regarded as constituting the ultimate structure of the metal, were found to enclose a subcrystalline formation consisting of very minute and much smaller crystals of pure iron also belonging to the regular order of crystallization. These crystals sometimes manifested the hexagonal form; and often they assumed the shape of simple cubes. The linear dimensions of the primary crystals would average about 0·01 inch; the secondary crystals only averaging 0·001 inch linear measurement. Judging roughly from the indications of the average micro-measurements,

there would be approximately 1000 million of the secondary crystals in a cubic inch of the metallic iron. The crystallizing point of metallic iron is about 740° C. In the course of further investigation, Mr. Andrews has also found that the secondary crystals sometimes enclose a still more minute form of crystals of pure iron, of cubical form, which thus constitute a third system of crystallization. It is necessary to look for the second and third systems in large masses of the metal. The crystals of the secondary formation are not often distinctly discernible in smaller masses of metallic iron, such as rolled rods, plates, or sheets; as these in the course of manufacture rapidly cool, and are frequently manipulated during the finishing processes at temperatures below the crystallizing point of wrought iron.

The Principle of the Pohle Air-Lift.

Some observations on the Pohle air-lift for fluids are made in a recent issue of the *Engineering Magazine*. It is remarked, by way of explaining the principle of this most useful device, that it has long been known that a suction-pipe could be made to raise water considerably higher than the height of a solid column of water in a tube balanced by atmospheric pressure, by the simple device of allowing some air to leak into the suction pipe. This is due to the fact that a column of mixed water and air is lighter per foot of height than water unmixed with air; and hence the atmospheric-pressure upon the surface of the water wherein the suction-pipe is placed can push up a higher column of the former than of the latter. Yet it does not seem to have occurred to anybody until recently that water or any other fluid could be raised effectively through an open vertical tube inserted in a mass of liquid, by forcing air into the open end of the bottom of the tube; and that the farther below the liquid surface the lower open end of the tube is placed, the greater and more powerful will be the discharge, provided that the injection of air is rightly proportioned to the work required to be performed. The operation, after the air enters the lower end of the tube, is simply due to gravity. The mixed air and water is lighter than the unmixed water remaining outside, and is therefore pressed upward by the denser fluid. Of course, it follows theoretically that the deeper the lower end of the tube is submerged, the higher the mixed column of water and air can be raised above the surface. In practice, however, there are limits to the application of the principle. It is not advisable to exceed 150 feet, at one lift; but by placing a number of such lifts in series, it is possible to command any elevation. The beautiful simplicity of the arrangement renders it welcome to engineers interested in the raising of either clean water or dirty thick fluids; though few engineers can be made acquainted with the appliance without experiencing a feeling of astonishment, not unmixed with personal vexation, that such a means of raising liquids has remained undiscovered until these later days, when it might have been thought that every possible principle and device in regard to pumping must be well known. The Pohle invention must have been on the verge of disclosing itself thousands of times to engineers having charge of pumps and pumping; and yet it remained for Mr. Pohle to seize upon it in the fulness of time.

TECHNICAL RECORD.

WESTERN (U.S.A.) GAS ASSOCIATION.

(*Concluded from p.* 32.)

A report from the Committee on Federation set forth that as yet no Association had, by its vote, expressed a desire for federation; and they therefore recommended that further consideration of the subject be indefinitely postponed. They considered that the tendency of the times is in the opposite direction; and that "the remarkable display of vicious legislation in many States during the present year seems to demand local combinations, such as State Associations or State Gas Commissions, in order to effectually combat the various forms of pernicious politics."

A paper on "The Storing and Handling of Oils in a Gas-Works" was read by Mr. D. J. Collins, of Chicago. The author stated that Mr. M'Kay's paper, read before the New England Association last year,* fully covered the construction of tanks and the measurement of oil; and he did not intend to go over that ground again, but rather to submit a few practical points of a general character. Mr. M'Kay's paper was especially applicable to the larger gas-works; and the present one would be more for the small and medium-sized undertakings. Though there was less danger and loss by evaporation in working with crude oil than with naphtha, it must be remembered that crude oil in bulk was highly inflammable, and required due precaution, regularly maintained, to ensure safety. As they were used indiscriminately according to market values, the storage arrangements should be suited for dealing with either kind. As to the best form of tank, the horizontal cylindrical form was cheaper than the perpendicular cylinder or "cheese-box" shape; and it answered well in many cases. It could be conveyed for considerable distances; but it required careful handling in unloading and placing on the foundation, to avoid straining seams, &c. It was not easy to gauge the contents of a horizontal cylinder. On the whole, especially for large sizes, the cheese-box form was the best; but, in any case, the tank must be gas-tight as well as oil-tight. The upright form could be provided with a shallow tray top containing a few inches depth of water, which tended towards the maintenance of a uniform temperature, and reduced the risk of strains by expansion or contraction. A manhole on the top, as well as one at the side, near the bottom, was required; and there should be a vent, not open to the air, but connected to the inlet of the gasholder. All risk of danger and loss by the escape of vapours was thus prevented. Good asphaltum or plumbago paints were the best for oil-tanks. If set below the ground-level, the tank should not be buried in earth, but set in a pit of brickwork or concrete, so arranged as to leave the whole open for inspection; but the upright form might be set solid on a strong concrete foundation. The very best form of foundation was an outer ring of solid stone or brickwork, with radial cross walls according to size, and cross girders set flush with the top of the wall, to receive the bottom plates. It must be well drained, and provided with manholes to admit inspection of every part. It was the safest plan to put the tank in a water-tight pit, as, in case of rupture, the oil would be prevented from flowing over the premises; and there should be a light corrugated iron roof (not wood) to protect the tank from the summer suns and winter snows. A coil of steam-pipe inside the tank might or might not be necessary, according to the climate and the kind of oil used. A stock equivalent to from 30 to 60 days' requirements, depending upon circumstances, should be kept on hand; and the tanks must be located at a reasonable distance from buildings or places where lights were used. Pipe-lines should not be buried, but might be carried through old gas-pipes, fitted with drip-boxes as was usual for conveying gas, as any leakage could thus be detected. The main discharge-pipe from the tank-car to the storage-tank should not be less than from 2½ to 3 inches diameter. All threads should be truly cut; and a good plumbago grease was the best jointing material to employ. There ought to be no elbows or tees; and curves should be as easy as possible. Every run of pipe must be thoroughly tested before being used. These pipes should not be continued under the railway track, but should rise at the side; and even where the trend of the land admitted of discharging by gravity by a connection to the bottom of the tank, it was well to provide for pumping from the top if desirable. Some companies made a rule that the tank should be emptied by pumping. The rising pipe should be enclosed in a wooden case with lock and key. An 8 or 10 feet length of good rubber hose would be required for connecting up; and in pumping it should be remembered that oil could only be lifted about 22 feet vertically with ordinary pumps, on account of its volatile nature. In cold climates, a portable steam-boiler might be required for thawing any ice formed in the tank-car during the journey. Every cargo of oil should be tested by the hydrometer; and it was well to take a sample in a gallon jar and preserve it, in case the oil should turn out to be of bad quality. A handbook giving the capacity of every tank-car used for hauling oil in the United States had been published, and would prove useful to purchasers. In measuring the stock of oil, it must be remembered that oil expands 1 per cent. for every 20° Fahr. increase in temperature, and shrinks to an equivalent degree by cold. The inlet and outlet pipes of the storage-tank should be separate and distinct, and should be carried through the top, extended to the bottom, and then turned up about 12 inches, so as to avoid the disturbance of sediment or water. A third pipe carried close to the bottom was required for the removal of these matters; and all pipe-connections should pass through the top of the tank, and not through the sides or the bottom. Oil-meters were useful; but, as they were apt to vary, a small tank of known capacity should be fixed, so that they might be tested at least once a week. The use of lights, or smoking, in the vicinity of the tanks should be strictly forbidden. Pipe-lines might be up to a mile in length; but if they could not be used, a tank-waggon drawn by horses would be required. Gas companies situated at a distance from the railway need not be deterred from adopting water gas on this account, as it was as cheap to convey oil as it was to haul coal, taking their respective gas-producing capabilities into account.

Discussion having been invited, Mr. Humphreys said the statement as to horizontal tanks being cheaper than upright ones applied only to those of small capacity. As the size was increased, the cheese-box form became much the cheaper. He was inclined to think that the better practice was to leave out the manhole at the side. It was not used more frequently than about once a year; and any bolted joint on the side of the tank introduced an element of weakness. Before connecting the vent to the gasholder, he advised that the whole subject should be thoroughly investigated. Under some circumstances, a sufficient quantity of vapour would pass off to altogether upset the manufacturing records, especially if the storage-tank was unprotected, and exposed to the sun. He was in favour of having all connections through the top of the tank, if possible; but some tanks were so deep that the oil could not be lifted the entire depth. Too much attention

* See JOURNAL, Vol. LXIII., p. 635.

could not be given to provision against danger by fire. As water was often valueless, a good plan was to keep a stock of dry sand ready for emergencies. If the storage-tanks were well protected, and cooled with water when necessary, he did not object to connecting the vents to the foul main; but even then a lot of vapours might pass over and be lost. If storing heavy oils, he did not mind connecting with the gas-mains; but with light oils, he would have two relief-valves—one in and one out—open to the air, and risk the loss of naphtha vapours, rather than interfere with the quality of the gas. Mr. Thompson said he had two tanks, placed under a covered shed, which had been worked for nine years; and the vents were connected to the gasholders. The loss of vapour was slight; and no trouble had arisen. They held 17,000 gallons each; and a third, having a capacity of 107,000 gallons, was connected in a similar manner last year. Under ordinary circumstances, the stock was kept about the same. The length of pipe between the gas-main and the storage tanks was 400 feet. It was fitted with a syphon; but there was very little deposition of liquid. Mr. A. S. Collins said a steam-pipe in the tank was very useful in case of fire. If the contents of the tank caught fire at the top, the flames could be easily extinguished by blowing in steam. He asked if the correction for temperature which had been quoted represented the actual expansion of the oil, or the differential expansion between the oil and the iron tank. Mr. Odiorne said he once connected a vent-pipe from a storage-tank to a gas-service that happened to be handy. But he found that sufficient vapour passed over to interfere with the supply on the service; and he consequently had to discontinue the plan. Mr. Clark remarked that he could not believe that any bad result would follow from joining the vent to the gasholder, if the tank was protected as suggested in the paper. He had recently connected a tank of 300,000 gallons capacity to the foul main, and found that very little vapour passed over. Sand was a good thing to use in case of small outbreaks of fire; but steam was better for large ones. Mr. Forstall said he unloaded his supply of oil by gravity, and carried it through some 250 yards of pipe without the slightest difficulty. The siding was 30 feet higher than the works. Mr. Collins, in replying, said the correction for temperature was a practical rule which was approximately correct. He reminded the meeting that his remarks applied more particularly to the smaller class of gas-works. The suggestion to keep a stock of sand for extinguishing fires was an excellent one; but a good fire-extinguisher would also successfully cope with small fires.

A paper on "Natural Gas as a Pioneer for Artificial Fuel Gas," by Mr. Donald M'Donald, of Louisville, was not read, on account of the author's absence; but it was ordered to be printed in the official report. Mr. M'Donald states that natural gas has been the means of spreading instruction on the advantages of gaseous fuel, and has also demonstrated that the demand for gas for fuel purposes will be at least ten times as great as that for lighting. It has also afforded the means for practical experiments that have led to great improvements in the efficiency of gas appliances. Not only that, but pipes and fittings were laid that could, without alteration, be used for artificial gas. The result was that, if natural gas were to fail in any city where an artificial substitute could be supplied at 3s. 4d. or less, there would be a large demand for the latter. But old gas companies, saddled with large capital, should consider their position, and lay themselves out to supply gas at a price that would prohibit competition. There would be such a large demand for gas at the lowest possible price, that if the existing concerns could not meet it, new ones would be rapidly formed. He believed that gas could be supplied with profit at a rate that would induce the wealthier classes to use it to the entire exclusion of coal. Attention was then directed to the use of gas for heating and cooking purposes. The necessity for good ventilation was insisted on; and the author thought that gas companies should do more than they have done in the way of instructing gas consumers. At present the gas was blamed for defects really attributable to the ignorance of makers of showy, but badly constructed, appliances. Returning to the subject of the paper, he said he considered that the apparatus eventually adopted for making cheap fuel gas would combine the coal and water processes. The volatile matters would first be driven off, and the residual coke completely gasified. Natural gas had also shown that large fluctuations in demand would have to be provided for; and he thought these would need not only capacious storage, but also large generating plant, including generators that could be set to work in a few hours. It must be remembered that the stoppage, or even the shortness, of the fuel-gas supply would be a very serious matter. With the insufficient supply of natural gas, the artificial substitute would be gradually adopted as an auxiliary. It would be used in mild weather; reserving the coal for prolonged winters. While the adoption of gas for fuel in anything like a general way would be a question of time, he instanced the advance already made; and he urged gas companies to turn their attention to the supply of cheap gas for fuel purposes, and to the encouragement of substantial improvements in gas-stoves.

Mr. G. T. Thompson, the Editor of the "Wrinkle" department, submitted a number of suggestions received from various members. Mr. F. Egner, having been greatly troubled with naphthalene deposits in the purifiers, while running ordinary water-gas apparatus, traced the cause to too much surface in the carburettor and fixing-chamber. He connected an oil-inlet to the bottom of the superheater, and ran the supply of oil in at that point occasionally. This not only removed the deposits, but enriched the gas; so he supposed that the naphthalene was retained in the gas. This difficulty would not have arisen with retort-house coke in the generator, as it heated up more quickly; but he had to use anthracite. He preferred this plan to blowing away some of the producer gas, admitting an excess of air, or taking out some of the fire-brick from the superheater or the carburettor. This suggestion was criticized by Mr. Humphreys and Mr. Miller, who preferred reducing the temperature in the superheater, if necessary, by other means, to bye-passing the oil. They thought there was some risk of unfixed oil vapours going through with the gas. Good results might be shown at the works; but the gas might not be permanent.

Another "wrinkle" was a simple device for testing a length of pipe, or a system of house fittings, for soundness. It consisted of a Woulff bottle, with a junction between the inlet and outlet. The inlet-tube is lightly sealed in water; and the apparatus is connected to the system to be tested from the outlet. The inlet is joined up to any convenient source of pressure. The bye-pass is opened, and the whole put under inlet pressure. It is then closed; and if there is any leak, the pressure falls. A series of bubbles going through the liquid from the inlet roughly indicates the extent of the leak.

Several other "wrinkles" were also discussed; and Mr. Thompson received a hearty vote of thanks for his labours. The "question-box" was then opened; and its contents somewhat hurriedly read. After this the meeting closed with the usual vote of thanks.

Extensions at the Matlock Bath Gas-Works.—The Matlock Bath Gas Company have lately increased their capital by £3000, to enable them to carry out extensions at their works. They comprise a gasholder of 60,000 cubic feet capacity, with a steel tank; an improved tower scrubber, 50 feet high; annular condensers and washers; a new exhauster; and regenerator furnaces on Mr. W. R. Chester's principle. Land adjoining the Company's present property at Matlock Bath Station will be utilized for the new works, the Contractors for which are Messrs. R. Dempster and Sons, Limited, of Elland. The foundation and preparatory work is being carried out under the direction of Mr. A. W. Elton, the Engineer and Manager of the Gas Company.

Lisburn New Water-Works.—Mr. C. P. Cotton, M.Inst.C.E., held an inquiry at Lisburn last Tuesday respecting an application by the Town Commissioners for the sanction of the Local Government Board for Ireland to an additional loan of £5000 for the extension and improvement of the water supply. Mr. Young, who appeared for the Town Commissioners, stated that they had already paid in cash on the new water-works £10,487; and in miscellaneous expenses, including fees and law costs, £1020. The contract for the construction of the works was for £16,000; and it was estimated that the extras would amount to £2000, and the miscellaneous expenses to £2012. The total sum already sanctioned for the works is £27,000; the total required being £32,000.

The South Staffordshire Water Company and the Water Supply of Wednesbury.—Complaint was made at last week's meeting of the Wednesbury Town Council as to the inadequate supply of water in various parts of the town. The district is supplied by the South Staffordshire Water Company; and the Gas and Water Committee reported that they had written to the Company urging them to deal with the matter forthwith. Alderman Williams asked that some allowance should be made for the difficulties which the Company had had to encounter. During February and March they lost, he said, seven million gallons of water owing to the frost; and since then the drought had very severely affected their supply, which had never been shorter than at the present time. They were doing all they could in the way of pumping; and at the last meeting of the Directors, the wants of Wednesbury were specially considered, and arrangements were made, irrespective of pressure on the part of the Corporation, to lay down additional pipes in the town. Several councillors afterwards supported the complaints on behalf of different districts, and argued that, if the Company could not furnish a full supply, they ought not to exact full charges.

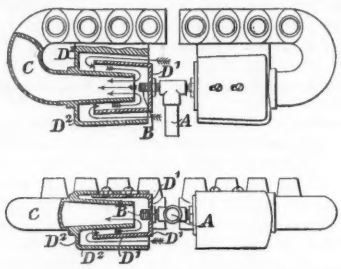
The Production of Gas at Oldham.—There has been some disagreement, at recent meetings of the Oldham Corporation Gas Committee, relative to the gas-producing quality of the coal used at the gas-works. Statements were made on the subject by Mr. Shaw and the Chairman (Alderman Smith); and these were remitted to a Sub-Committee for inquiry. The matters considered were the cost and quantity of coal and cannel used, the amount of gas made per ton, and the illuminating power at each station during the twelve weeks ending April 13 last, and the twelve months ending March 25. After taking into account the quantity of gas produced per ton at each station, the Sub-Committee found there appeared to be a difference of 1d. per ton of coal in favour of Hollinwood as compared with Higginshaw; but they could not ascertain to which particular coal, if any, this apparent advantage was to be attributed, seeing that there were five different kinds of material used at Hollinwood during the twelve weeks ending April 13. The statement for the twelve months ending March 25 showed that the average cost of coal, cannel, and haulage at each of the works was: Oldham, 11s. 11·288d. per ton; Higginshaw, 11s. 6·389d. per ton; and Hollinwood, 11s. 6·502d. Comparing the Higginshaw and Hollinwood stations as in the former case, by taking into account the increased make of 88 cubic feet per ton at the former station over the latter, and also the increased illuminating power of 0·6 candle, Higginshaw showed an apparent advantage of about 11d. per ton over Hollinwood. The Gas Committee have accepted as correct the findings of the Sub-Committee.

REGISTER OF PATENTS.

Atmospheric Burners for Gas-Fires.—Wright, G. E., of Birmingham. No. 13,243; July 9, 1894.

This invention is directed to minimize the risk of "lighting back" at the gas-inlet nozzle, when the gas is being burnt at a low pressure, or when there is a draught acting on the burner.

In the accompanying illustration, two gas-burners for a gas-fire are shown in part sectional plan and part sectional elevation.



A is the pipe conveying gas to both burners as usual, and B is the gas-inlet nozzle. C is the mixing pipe or chamber, having an inlet orifice at one end for the gas and air, and outlets at the other end where the mixed gas and air are burnt. The outer casing round the inlet end of the inner chamber C consists of two parts—D^1 D^2—the former of which is like a bell, rather larger than the inlet end of the chamber C. It encloses and extends some little distance along it. The outer part D^2 is like a larger bell enclosing the part D^1; so that the air, before entering the inlet orifice, has to pass along the spaces in the outer casing, in the direction shown by the arrows. In the event of the flame flashing back through the mixing chamber, the explosion in the chamber will force the mixed air and gas back towards the outer casing D^1 D^2, where the various turns will so baffle the mixed air and gas as to form an air-buffer, the elasticity of which will force the flame forward again, and thus prevent the gas lighting at the gas-inlet nozzle.

Gas Motor Tramcars.—Holt, H. P., of Manchester. No. 14,002; July 20, 1894.

This invention relates to engines and driving-gear for gas-motor cars, and to means of reversing the rotation of the motor shaft.

The crank-shaft is mounted in a vertical position about the middle of the car; having on its lower end a horizontal fly-wheel, from which, by bevel and suitable intermediate gear actuated at one side of the car, the wheels of the car are driven. To the crank on the vertical shaft are connected the pistons of two horizontal cylinders, one at the side of the car opposite to the gearing, and the other towards one end. The latter cylinder is provided with means for cutting off the gas supply, and allowing the piston to move idly, when the other cylinder is sufficient to give the necessary power. It is thus possible to dispense with a second set of slow-speed gear for starting and ascending gradients. Besides the second cylinder mentioned as being situated towards one end of the car, there may be a third cylinder towards the other end—this cylinder also being provided with means for cutting off the gas supply.

For the purpose of reversing, the patentee in the first place arranges the ignition-gear so that the cylinder charge is always ignited a little before the piston reaches the end of its instroke. Thus, when the engine is going slowly (the fly-wheel having little momentum), the combustion of the charge propels the piston in the direction opposite to that in which it was proceeding towards the extreme of its instroke. An arrangement of cams work the gas and air supply valves, the exhaust-valve, and the ignition-gear. They are not fixed in position on the valve-shaft, but are driven by stops fixed thereon; so that, when the rotation of the shaft is reversed, they take a position relatively to the crank to suit the reversed motion.

A centrifugal governor controls the gas-supply valve, according to the speed of the engine; and a spring bearing against the sliding sleeve of the governor aids the centrifugal force. There is connected to a lever, on which one end of this spring bears, a pair of slides (faced with leather, wood, or the like), one of which—by means of a hand-lever—can be pressed upon the engine-shaft or the valve-shaft, to effect reversal. When the slide is so pressed, it is caused by the friction on the revolving shaft to travel in such a direction as to compress the spring, which, aiding the centrifugal force, causes the governor to operate as if the speed of the engine were excessive. This cuts off the gas supply, until the speed is so far reduced that the fly-wheel has scarcely sufficient momentum to carry the crank over its back centre. A gas charge then admitted to the cylinder is fired by the ignition taking place just before the back centre is reached; and thus the engine is reversed, as stated above. The slide is now caused, by its friction on the reversed shaft, to travel backwards; relieving the governor sleeve from the spring, and so restoring the governor to its normal condition.

Retorts.—Teisser, N., and Nègre, G. L. A., Uzès, France. No. 14,553; July 28, 1894.

The object of this invention is "to provide retorts which shall have as great a resistance to heat, which shall be as easily manipulated and adapted for transport as those hitherto generally employed, and which shall have a greater extent of heating surface, and be more permeable to heat." To this end, the patentees propose, instead of making the retorts with thick and smooth walls, as hitherto, to form them with walls of comparatively less thickness, and with undulating surfaces—such undulations being arranged either longitudinally or transversely, and extending either over the whole surface or over only a part, as may be desired.

Prepayment Gas-Meters.—Simmonds, H., of Colne. No. 15,747; Aug. 18, 1894.

This coin-freed gas-meter has its supply-valve connected to gearing which can be thrown into gear either with a handle capable of being rotated to open the valve, or with the index mechanism of the meter to close the valve—the connection for operating it being provided by the insertion of the coin. There is also a combination of mechanism, for stopping or preventing the movement of the meter when the valve is in gear with the operating handle.

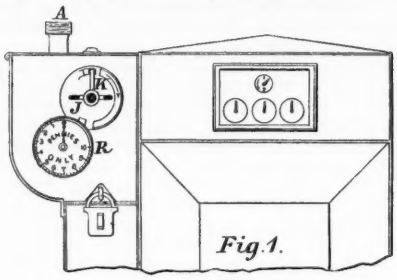


Fig. 1.

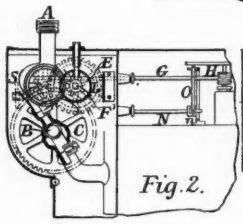


Fig. 2.

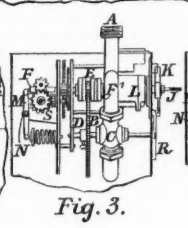


Fig. 3.

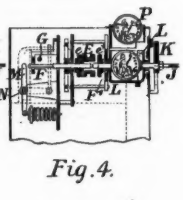


Fig. 4.

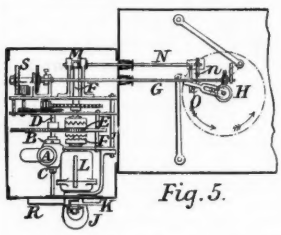


Fig. 5.

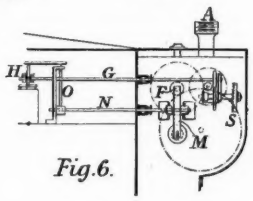


Fig. 6.

Fig. 1 is a front elevation of the meter, showing the apparatus fixed to the side. Fig. 2 is a longitudinal section; fig. 3, an end elevation; fig. 4, a transverse section; fig. 5, a plan with the top cover removed; and fig. 6, a back elevation.

To the inlet-pipe A is connected a valve B, fitted in a chamber C; the valve being attached to, and operated by, a spindle D, capable of being rotated in either direction. The valve may be of such construction that it can be opened by the rotation of the spindle in one direction, and closed by its rotation in the opposite direction. The form of valve preferred is a plug-valve, cut away to such an extent that it remains open during the greater part of the revolution of the spindle; and the spindle is operated in either direction by a toothed wheel fixed thereon, gearing with the wheel E on the driving shaft or spindle F. This driving-wheel E is loose on the shaft; and it is provided at each side with clutch teeth. On the shaft at either side of the driving-wheel, are placed two clutch wheels made fast to the shaft, so that the direction of rotation of the driving-wheel and of the valve B are consequent upon which of the clutches is in gear with the wheel. The second or driving shaft F is divided in its length into two parts; one of the clutches being affixed to each part. One end of the shaft is connected, by a train of wheels and a shaft G, with the index mechanism H of the meter; while the other end F^1 is connected by the coin-receptacle L with a knob or handle J (outside the apparatus) by which it can be rotated. The handle is carried by a spindle, to which is also affixed a radial arm or finger K.

On the outside of the casing is fixed a quadrant guide and two stops for the radial arm. This arm rests against the top stop; and when the knob is to be rotated, it is removed from the stop and pressed inwards. But as it rotates, it is held in this position by the arm K pressing against the inner side of the quadrant guide. When it completes half a revolution, the finger emerges from beneath the quadrant-guide, and comes against the stop—the coin being released. Between the spindle which carries the handle J and the end F^1 of the driving-shaft is pivoted a chamber L, of cylindrical or other shape, to receive the coin passed into it through a slot. Into this chamber, the ends of the spindle project; and the position of the coin is edgewise between them. The ends of the spindle and shaft are made square, so that, as the knob J is rotated, the receptacle L, and with it the shaft F^1, is rotated.

The clutches at either side of the loose driving-wheel E are attached respectively to the parts F F^1 of the driving-shaft; and on the shaft being moved in either direction longitudinally, one of the clutches engages with the loose wheel E and rotates it—the motion being conveyed to the spindle D operating the valve B. In its normal position, the clutch in connection with the shaft G and index mechanism H is in gear with the wheel E. After the coin P is inserted in position, by pressing inwards the handle J before rotating it, the end F^1 of the driving-shaft is also pressed inwards, one clutch thrown out of gear, and the other brought into gear with the loose wheel E. The driving-shaft F is moved back again into normal position by the spring lever M, which bears against the end, and is actuated by a spring. The lever M is fixed to the shaft N, which is rotated part of a revolution at each movement of the lever. At the other end of the shaft N is another lever or rod, connected to a bolt O. When the driving-

shaft F is pushed backwards or inwards, by the action of the handle J and coin P, this bolt is thrown up to engage with the moving part of the meter, and stop all motion thereof, so that the passage of gas through the meter is stopped during the time the coin is in the apparatus. This prevents a supply of gas being obtained should an attempt be made to block the supply-valve open.

To the valve-spindle D, a dial R and indicating-finger may be connected, to show to what extent the valve B has been opened, and how far it remains off being closed. To this, any additional counting or recording mechanism may be applied. The edge-wheel S can be changed to one of greater or less diameter, to alter the speed of the mechanism and the rate at which the valve is closed, according to the amount of gas for which one coin pays.

In operation, the coin P is inserted in the slot, and dropped down into the chamber L; and the handle J is rotated and pressed inwards. The finger K on the spindle then passes behind the inner side of the quadrant or cam, which holds it until half a revolution has been made. The inward movement brings the outer clutch into gear with the loose wheel E, and throws the other clutch out of gear. At the same time, the bolt O is thrown up to stop the working of the meter; and the rotating movement causes the clutch and wheel E to rotate, and with them the spindle D of the valve B, which is thereby opened for a certain distance. When half a revolution has been made, the finger K emerges from behind the quadrant, draws back the spindle, and releases the coin—allowing it to fall out of operation. The driving-shaft F is then moved back by the spring, and brings into gear with the wheel E the clutch, which communicates with the index mechanism H; and at the same time the bolt is drawn down, allowing the meter to work. This clutch moves in the opposite direction to the other, and slowly closes or returns the valve to its seat as the gas is consumed.

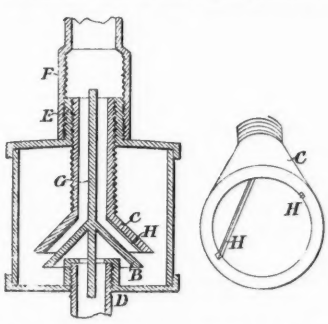
Igniting and Extinguishing Gas-Jets Simultaneously from a Distance.—Morstein, O. von, of Berlin. No. 4670; March 5, 1895.

This invention has for its object to provide means for igniting and extinguishing any number of gas-jets, with the use of only one conductor and one contact.

For this purpose, an electro-magnetic gas-closure opener, common to all the jets, is applied at any convenient part of the common gas-supply pipe; but the ignition of the jets is effected by secondary induction currents. The electric opening and shutting-off of the gas-pipe is effected by means of two different electro-magnets or two different conductors; and the gas-pipe may serve as the one conductor for the battery current, as well as for the secondary currents. The gas-cock opener and the inductor are in intimate connection with each other; both being set in activity by the same battery current, the same conductor, and the same contact. The same current—that which excites the opening electro-magnet—produces in the secondary bobbin the secondary current required for the ignition of the gas-jets, by means of intermittently springing sparks. This may be accomplished either by employing the opening electro-magnet itself as a primary bobbin, and placing the secondary bobbin directly over it, or else by practically separating a portion of the opening electro-magnet, and employing this portion as a primary bobbin.

Gas-Burner Regulators.—Feeny, V. I.; communicated from the "Faultless Gas-Saver Company," of San Francisco, California. No. 7709; April 17, 1895.

This device for regulating the flow and pressure of gas is shown in the illustration—a vertical section and a perspective view of the valve-seat.



The casing is of sufficient size to contain the valve B, and the valve-seat C. At its lower end, it can be secured to the upper end of the gas supply-pipe D; while from the top of the case a tubular extension E is provided, on which the burner-tube F is screwed. The valve-seat is in the form of a hollow cone, having a hollow extension adapted to screw into the inner threads of the extension E at the top of the case, so that the valve-seat will be but a short distance above the open end of the pipe D and the apertures through which gas flows into the case. The valve B has a stem G, extending up within the hollow extension of the valve-seat, and also down through a hole made in the part into which the pipe D is secured; so that the stem is suitably guided, and the valve allowed to rise and fall at will. The interior of the valve-seat has grooves H made in it (extending from the bottom up to a point where they connect with the interior passage), for the purpose of allowing a small flow of gas when the valve has been closed.

The valve B is so arranged with relation to its seat and the inlet opening, that, under a certain pressure of gas, the valve will remain open sufficiently to allow the desired amount of gas to flow through the extension of the valve-seat, and thence to the burner. If the pressure be increased, the valve will be closed against the seat C; but the grooves or channels H would still allow the proper proportion of gas to flow to the burner under the higher pressure, so that whatever increase of pressure takes place within the supply-pipe, no greater amount of gas will flow to the burner.

Overhead Regenerative Gas-Lamps.—The Lamp Manufacturing Company, Limited, of Leonard Street, City Road, and Welch, W. H. I., of Coborn Road, Bow. No. 8318; April 26, 1895.

This invention relates to a compact construction of the passages for the entering air and the issuing products of combustion in an overhead regenerative gas-lamp.

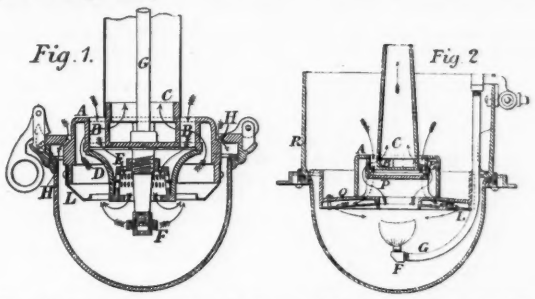


Fig. 1 is a vertical section of a lamp, with the passages adapted for a circular flame. Fig. 2 is a vertical section of a flat-flame lamp.

The passages for the entering air and for the issuing products of combustion are formed in a casting A, having its upper and lower sides integral with a number of tubular bosses B connecting them. Air entering to supply the flame flows through these bosses; while the products of combustion flow around and through between the bosses on their way to the chimney C. When the flame is circular, the heated air passes into a casing D, and through a perforated shell E, to supply the upper side of the flame of the gas issuing from the perforations of the burner F. The casing D is held up to the casting A by the shell E, which is screwed on to the gas-pipe G. The air to supply the under side of the flame enters by perforations H in the flange of A, and flows into the interior of the globe. The products of combustion flow through an annular opening in the reflector L, ascend outside the shell D, and flow through, between, and around the bosses B to the chimney C. The casing D and the casting A, being heated by the products of combustion, impart heat to the air entering to supply the flame.

When the lamp has a flat-flame burner (fig. 2), the products of combustion flow through an elongated aperture into an arch P; thence each way and up; then between and around the bosses B to the chimney C. The air enters through the bosses B; descends on each side of the arch P into a space above the reflector L; and thence through perforations in the reflector into the globe, being highly heated on its way. The arch P is formed through a cylindrical boss projecting upwards from a horizontal disc Q, to which the reflector is fixed, and which has a flange resting on the internal flange of an outer casing R.

APPLICATIONS FOR LETTERS PATENT.

12,105.—Crocker, S. H., "Radiant tissue for lamps." June 21.

12,216.—Radclyffe, D. E., and Burrows, T., "Preventing water-pipes of lead or the like bursting through freezing." June 24.

12,222.—Gordon, J., "An improvement in water-pipes by which water is delivered free from lead poisoning and the chances of damage by frost are greatly diminished." June 24.

12,234.—Powlesland, T., "Illuminating apparatus." June 24.

12,245.—Sweetster, A., "Production of oxygen gas." June 24.

12,247.—Singer, P., "Gas or oil engines of the 'Otto' cycle." June 25.

12,289.—Brock, L., "Gas heating apparatus." June 25.

12,344.—Exley, J. H., "Generating acetylene gas." June 26.

12,355.—Thorp, T., and Marsh, T. G., "Gas-producing lam ps." June 26.

12,356.—Thorp, T., and Marsh, T. G., "Production of heating and illuminating gas." June 26.

12,385.—Bark, J. P., "Improvements in or appertaining to domestic water supply apparatus or the like." June 26.

12,437.—Watkinson, W. H., "Rotary motors of the reaction type, applicable for the utilization of steam, gas, or hydraulic pressure." June 27.

12,527.—Bergmann, F. J., "Extraction of distillation products from sawdust, wood waste, and the like." June 28.

12,528.—Linde, C., "Liquefying gases or gaseous mixtures, producing cold, and separating oxygen from atmospheric air." June 28.

12,560.—Wheatley, W., and Somerville, J. M., "Manufacture of carburetted water gas, and apparatus therefor." June 29.

Belfast Corporation Gas-Works.—The Belfast Gas Committee have accepted a tender of the Gas-Meter Company, Limited, for the supply and erection of a station-meter, to pass 100,000 cubic feet of gas per hour.

Compensation in Respect of an Easement for a Water Conduit of the Bradford Corporation.—Arbitration proceedings have recently been conducted before Mr. B. S. Brundell, at the Bradford Town Hall, in respect of an easement for a water conduit belonging to the Corporation of Bradford, through the estate of Mr. W. Ferrand, of St. Ives, Bingley. Mr. W. Middleton acted as Arbitrator for Mr. Ferrand; and Mr. T. Fenwick for the Corporation. The claim was for £3028 for the easement of a conduit 1499 yards long, and 740 square yards of land, which it is proposed to acquire as freehold for water-valves and for the erection of an aqueduct over the River Aire. The Corporation contended that the claim was greatly exaggerated. Evidence was called to show that £360 would be an ample price for the easement area, for which £562 was asked. A claim of £400 for the land to be occupied by the valves was regarded as most unreasonable; as was also the supposed depreciation of £60 each to twenty sites for villas. The other items making up the total claim were, it was argued, equally absurd. The Umpire's award has not been published.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

Professor Lewes's Report on English Gas Fires, Stoves, &c.

SIR,—I regret that my deafness prevents my attendance at The Gas Institute meeting, or I should have called attention to some very important points overlooked by Professor Lewes.

So far as our patterns of incandescent fires are concerned, these are designed to give their maximum duty with a gas-pressure not exceeding 7-10ths at the jet. At this pressure, a consumption of 40 cubic feet per hour is impossible with any of our fires tested. The fact that flame was visible at the flue outlet, shows that more gas was passing than could be consumed in the fire; and it would appear that this may be the cause of the average low duties obtained with every make of fire tested. The maximum gas-pressure with a fire is quite as important as with a lighting burner, if economy is to be considered; and, to judge fairly of the comparative duties, the gas-pressure in each case is a necessary factor.

With regard to the production of a high temperature flame of small size, and a perfectly explosive mixture, this is a very simple matter with a properly proportioned mixing-tube and jet; but there are in many cases practical objections to such a burner, if placed in unskilled hands. Unless of very small size, it is sensitive to every variation of pressure, and requires minute adjustment to every small variation in the quality and composition of the gas used. It is, in fact, a burner for small work, or for experts only, and one which cannot be sent out by the hundred thousand, to be used by the ordinary domestic servant, however perfect it may be theoretically. Flames of this class under some conditions, not well understood, are also occasionally sensitive, jumping in the most erratic way to certain sounds—in fact, one pattern of burner, designed to give a short flame of high temperature without mechanical aid, had to be withdrawn from sale for this reason only, although at times it would burn with perfect steadiness for days together. The use of an electric motor to every burner is out of the question in ordinary practice. The same result has been obtained in a well-known petroleum lamp, and also in the Lewis incandescent burner, by the use of a supplementary air supply, under low pressure obtained from a fan driven by clockwork—one fan supplying any number of burners. The Denayrouze burner referred to by Professor Lewes does not appear to be the form originally patented, which had the objections of a possible red-hot fan bearing, and a revolving shaft, which would always be at a red or white heat. The new form requires a current of electricity to work it, and a separate motor for every burner, which is certainly no recommendation. The Lewis burner, although a commercial failure, possibly was so only because it was before its time, coming as it did, when expense and complication of parts were fatal to commercial success.

These mechanical aids are all more or less troublesome and expensive; and in practice the same result could be obtained without any supplementary aid, by an increased gas-pressure, provided this pressure is kept constant. Given this, or its equivalent in a fan or other method of increasing the supply of air, the prevention of lighting-back, with nearly perfect explosive mixtures, is easy, in such small burners as are used for incandescent lighting, either by reducing the diameter of the tube, using a cluster of small bore, instead of one larger size, or by the lengthening of the ordinary tube, and introducing two or three sharp curves—neither of these being at all practicable without some mechanical aid to increase the speed of the current, or a heavy gas-pressure.

With the fullest appreciation of Professor Lewes's work, it must be remembered that makers of burners for heating purposes have to consider the majority of the users, and their absolute ignorance of the necessity for any care or knowledge of conditions which may be required. Gas engineers have to consider the uneducated crowd, not the expert. He is no trouble; and what he wants is usually an easy matter, as the manufacturer is not hampered by the ignorance of the user.

With regard to the shortening of the flame, and consequent increase of temperature, this, except on the smallest scale as previously stated, is not practicable without mechanical aid of some kind to increase the speed of combustion. I have carried this system out in practice to the extreme extent of doing without flame entirely, and for the last 15 years have made, and my present firm still make, large quantities of absolutely flameless burners, which will produce a blinding white heat. But these are for laboratory use only, and are totally unfit for the average user of gas as a fuel.

I think those who are fully acquainted with the necessities of commercial practice, and also with the work done by English and Continental manufacturers, will acknowledge that the English are far from being the last in the race, and are quite in a position to hold their own. I fully appreciate Professor Lewes's work in every way, and trust, as a personal friend, that he will take my criticism as it is intended, in a purely practical and commercial sense.

THOS. FLETCHER.

Warrington, July 6, 1895.

New Water Pumping Machinery for Liverpool.—Messrs. Hathorn, Davey, and Co., of Leeds, have secured from the Liverpool Corporation the contract for the supply and erection of pumping machinery at the Aubrey Street high-level station, for the sum of £3800.

New Water Reservoir for Preston.—The Preston Corporation have commenced at Alston the construction of a new reservoir which it is estimated will cost about £60,000; and the amount to be spent on new mains in connection therewith is put at £35,000. The work is being carried out under the direction of Mr. H. Reah, the Borough Surveyor. The area of the new reservoir is about 37 acres; and it will have a storage capacity of 275 million gallons. Being 324 feet above the level of the sea, a good pressure is assured from it. Its greatest depth will be 39 feet. The total capacity of the existing reservoirs is something like 253½ million gallons.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress was made with Private Bills down to the prorogation of Parliament (last Saturday):—

Bill reported, with amendments: Bray Township Improvement Bill.

Opposition withdrawn: Croydon Corporation Bill.

Bills read the third time and passed: Bray Township Improvement Bill; Cranbrook District Water Bill; Croydon Corporation Bill; Local Government Provisional Order (Gas) Bill.

Bills Royal Assented: Bray Township Improvement Bill, Bridlington and Quay Water Bill, Brighouse Corporation Bill, Chesterfield Gas and Water Board Bill, Cranbrook District Water Bill, Croydon Corporation Bill, Merthyr Tydfil Local Board Water Bill, Water Orders Confirmation Bill.

HOUSE OF COMMONS.

The following further progress was made with Private Bills down to the prorogation of Parliament:—

Bill read the first time: Dewsbury and Heckmondwike Water Bill.

Bills read a second time and committed: Chesterfield Gas and Water Board Bill; Gas Orders Confirmation Bill; Gas and Water Orders Confirmation Bill; Water Orders Confirmation Bill.

Bill reported, with amendments: Merthyr Tydfil Local Board Water Bill.

Bills reported, without amendment: Chesterfield Gas and Water Board Bill; Water Orders Confirmation Bill.

Bills read the third time and passed: Chesterfield Gas and Water Board Bill; Merthyr Tydfil Local Board Water Bill.

Petitions against the Barnsley Corporation Water Bill have been presented from the Corporations of Doncaster, Rotherham, and Wakefield, the Stockbridge, Swinton, and Hemsworth District Councils, the Duke of Norfolk, Messrs. S. Fox and Co., Limited, the Wakefield Rural District Council, the West Riding County Council, the West Riding Rivers Board, and Owners, &c., of works and property on the River Don.

Under a Standing Order passed on the 2nd inst., in view of the dissolution of Parliament, the following Bills in which our readers are interested have been suspended at the stages named: After first reading—Barnsley Corporation Water Bill, Chelsea Water (Transfer) Bill, Dewsbury and Heckmondwike Water Bill, East London Water (Transfer) Bill, Grand Junction Water (Transfer) Bill, Kent Water (Transfer) Bill, New River Water (Transfer) Bill, Rotherham Corporation Bill, and West Middlesex Water (Transfer) Bill. After second reading and committal—Chelsea Water Bill, Lambeth Water Bill, Lambeth Water (Transfer) Bill, and Southwark and Vauxhall Water (Transfer) Bill. The Gas Orders Confirmation Bill and the Gas and Water Orders Confirmation Bills, received from the Lords, are also suspended.

HOUSE OF COMMONS COMMITTEE ON LONDON WATER BILLS.

Dissolution of the Committee.

Last Wednesday a quorum of the Hybrid Committee on London Water Bills assembled for the purpose of making a final pronouncement as to their course of action in view of the recent change of Government and the impending dissolution of Parliament.

The CHAIRMAN (Right Hon. D. Plunket) said that, according to the decision come to by the Committee on the previous Friday (*ante*, p. 41), as there was no reasonable prospect of their being able to hold continued sittings probably beyond the next Monday or Tuesday, they had nothing to do but to dissolve. As would be remembered, the meeting that day was only summoned in case there might be any alteration in the prospects of an early dissolution of Parliament. There was no such alteration; and therefore he had nothing more to do but to thank Counsel for the assistance they had given the Committee in the course of their somewhat arduous labours.

The Committee then dissolved.

The Chairman subsequently presented to the House the following report from the Committee: "That, in the case of the Lambeth Water (Transfer) Bill, the Committee were of opinion that, as it would not be possible to conclude the case before the rising of the House, the consideration of the Bill, which had been partly considered by them, should not be further proceeded with during the present session; that, in the case of the Southwark and Vauxhall Water (Transfer), Lambeth Water, and Chelsea Water Bills, the Committee were of opinion that the consideration of the said Bills should not be entered upon during the present session."

HOUSE OF COMMONS COMMITTEE.

The Salford Gas Provisional Order.

A Select Committee of the House of Commons, presided over by the Hon. A. de Tatton Egerton, had under consideration last week the Bill prepared by the Local Government Board to confirm certain Provisional Orders; among them being one applied for by the Salford Corporation for power to raise a further sum of £85,000 for the purposes of their gas undertaking. The application was opposed by the Swinton and Pendlebury Urban District Council, whose district is supplied with gas by the Corporation.

Mr. BALFOUR BROWNE, Q.C., the leading Counsel for the Corporation, said they had power to borrow on the security of the rates, for

gas purposes, a sum not exceeding £134,000. This had been found insufficient for the wants of Salford and the outside districts they supplied; and the proposal now was to increase the amount by £85,000. The matter had been inquired into on the spot, and had been sanctioned by the Local Government Board. The only opposition now was that of the Swinton and Pendlebury District Council, who complained that they had to pay higher prices than were charged within the borough. The fact was that in Salford the small consumers were charged 2s. 4d. per 1000 cubic feet, as compared with 2s. 6d. in the Swinton district; the large consumers paying 2s. 3d., as against 2s. 4d. In other outside districts, the charge was higher than in Swinton and Pendlebury; but this was inevitable. The prices were, as a matter of fact, very low indeed; and the £85,000 would be spent in such a way as would enable the Salford Corporation to reduce them both within and outside the borough.

A number of witnesses were called on behalf of the Corporation, to show the necessity for the additional loan; and it was stated that part of the works proposed to be erected would be within the Swinton district.

The cross-examination on behalf of the District Council was mainly directed to the accounts; it being alleged that too large profits were made by the Corporation out of the gas undertaking, and that the Swinton district did not get the benefit of these. It was also alleged that the capital expenditure had been considerably in excess of the legitimate requirements of the undertaking. The petitioners asked that, if the Order were granted, it should contain provisions for abolishing the differential rate now existing in their district, and providing that the price charged for gas should be the same in Swinton as in Salford; for reducing the price from time to time, either by adopting a sliding-scale or otherwise; for limiting the amount of profit to be hereafter made by the Corporation in respect of their gas undertaking, and defining the amount of capital on which the profit was to be based, for enabling the Swinton district to participate in a fair proportion in any profits; for abolishing the depreciation fund of the Corporation in relation to the gas undertaking, or limiting its amount, and providing for its application solely to the purposes for which it was authorized to be established; for applying to the Corporation, in relation to their gas undertaking, the general law relating to gas-works, with the necessary modifications; for requiring the Corporation to provide a testing-place with proper apparatus, within the Swinton district, for testing the illuminating power and purity of the gas supplied; and for the publication by the Corporation of the accounts relating to their gas undertaking, and the inspection of these accounts by the Swinton Council. It was submitted that while the difference in the price charged was nominally only 2d., the real difference was 8d. or 9d.; and it was alleged that the Corporation were charging too much all round, and taking, for the purpose of the rates, profits they were not entitled to.

A discussion took place as to whether there was time for the Order to become law in the session; and what would be the effect if the Committee stage were unfinished.

Mr. BOYCE, of the Local Government Board, stated that the officers of the House had informed him that, if the Committee stage were unfinished, the Bill would have to be taken up again at that stage.

Mr. BALFOUR BROWNE stated that the promoters did not intend to call their Accountant.

Mr. BIDDER, Q.C., who led on behalf of the petitioners against the Order, was about to call witnesses, when

The CHAIRMAN said it might shorten the proceedings if he stated at once that the Committee were of opinion that Salford should not alter the present proportion of the differential rate; and that the Committee were not prepared to change the whole incidence of the gas undertaking of the Corporation on the Bill before them. They thought there should be a limit of profit; and they suggested a margin not exceeding that of the year 1892-3. They further considered that the existing capital should be taken as a basis for a fresh start; that the depreciation fund should not be abolished, but be limited in amount, and applied solely to the purposes for which it was authorized; and that the Swinton Council should have power of inspection of the gas accounts.

Mr. BIDDER said he was prepared to accept these terms, with the addition that the actual limitation of the profits should be settled by the Local Government Board. He understood that the profits should provide for the payment of interest, and the sinking fund for depreciation, and leave a margin, so as to be on the safe side.

The CHAIRMAN: That is our intention.

Mr. BALFOUR BROWNE said he could not accept the decision of the Committee. Salford provided 94 or 95 per cent. of the profits, and no profits were made on the gas supplied to Swinton and Pendlebury. Under these circumstances, the Corporation would have to go without the additional capital, and would withdraw the Order.

The Bill was then amended by striking out the Salford Order.

Mr. BIDDER asked for costs.

Mr. BALFOUR BROWNE opposed the application.

The Committee, however, decided to allow them; and in reporting the Bill to the House, they made the following statement: "In the case of the Salford Order, the Committee were unanimously of opinion that the petitioners against the confirmation of the Order had been unreasonably subjected to expense in defending their rights proposed to be interfered with by the Order, and are entitled to recover from the promoters—namely, the Mayor, Aldermen, and burgesses of the borough of Salford—their whole costs in relation to the opposition."

A Supply of Water for Wilsden from Bradford.—The District Council of Wilsden have provided for the area under their jurisdiction a supply of water from the Thornton Moor reservoir of the Bradford Corporation. The reservoir is situated at a height of 1250 feet; and the Wilsden levels are from 900 to 600 feet. Wilsden has therefore an excellent pressure of water—being at the higher level 200 lbs. to the square inch, and at the lower level 250 lbs. The Chairman of the District Council (Mr. A. Ambler) turned on the water at the meter-house last Saturday week; the occasion being one of much rejoicing on the part of the inhabitants.

LEGAL INTELLIGENCE.

The Litigation between the Alliance Gas Company and the Dublin Corporation.

The proceedings taken by the Alliance and Dublin Consumers' Gas Company against the Dublin Corporation to compel them to fix proper meters to the public lamps (see *ante*, p. 42) were brought to a close last Saturday, when the Company obtained the injunction for which they applied. Our report of the conclusion of the case is unavoidably held over.

The Arbitration between the Yeadon Water Company and Wright.

This matter, which has been several times before the Courts (the last occasion being on March 5 last, when Mr. Justice Kennedy delivered the judgment of the Divisional Court in favour of the Company—see JOURNAL for March 12, p. 544), came on for argument on Monday last week before the Master of the Rolls and Lords Justices Kay and Smith in the Court of Appeal. Mr. Lawson Walton, Q.C., and Mr. Manisty appeared for Mr. Wright. They argued at some length that the Company were not entitled to deduct, as they had done, £1745 from the retention-moneys as liquidated damages for delay in the completion of the reservoir for which Mr. Brigg had contracted, and which Mr. Wright, one of his sureties, had undertaken to complete on the failure of the original contractor to carry out the work satisfactorily. Mr. Tindal Atkinson, Q.C., and Mr. Willes Chitty, who appeared for the Company, were not called upon. Their Lordships held that the decision of the Divisional Court was right; and they dismissed the appeal, with costs.

Deposits and Contracts.

At the Highgate Petty Sessions, on Monday last week, George Myers, of No. 5, Wellington Road, Walthamstow, was summoned for £4 15s. 9d. for gas supplied to 121, Turnpike Lane, Hornsey. Mr. Forbes appeared for the defendant. It appeared that the defendant signed the usual contract for gas, and for some time the matter went on very well, and the money was paid to Mr. W. D. Ovens, the collector to the Hornsey Gas Company; and the amount claimed was now due. Notice to discontinue was given on Feb. 1. Mr. Forbes said credit had not been given for the deposit. His client had not occupied since Dec. 18. The person who ought to pay was Mr. Gomm, who took over the premises. He had now left. Mr. Ovens said he told Mr. Myers he should hold him responsible till he received notice to discontinue. In answer to Mr. Tubbs (the Chairman), he said he was willing to take half the amount that was owing up to the time he gave notice. An order to pay £2 7s. 10½d., and 3s. costs, was made. In another case, the defendant, Mr. Youll, of Dartmouth Road, Forest Hill, was summoned for £1 5s. 1d. for gas supplied to his house in Tivoli Road, Crouch End. Defendant said a deposit of 10s. was paid; and if credit was given for that, he would pay. Mr. Ovens said this 10s. was paid for fitting the meter and connections in 1886. At that time, this was the amount they always charged; but now the fitting was done free. An order to pay the full amount, with costs, was made.

Bythesea v. Stroud Water Company.

This was a debenture-holder's action, which came before Mr. Justice Stirling in the Chancery Division of the High Court of Justice last Saturday. The plaintiff, represented by Mr. M'Swinney, is the holder of six debentures of the second issue; and he sued on behalf of himself and all other debenture-holders. The interest due on March 1 last was not paid; and on the 30th of that month an order was made appointing a receiver of the rates and tolls. An order was now made, in the usual form, directing an account of what was due to the plaintiff and other debenture-holders, with inquiries as to who were the holders of the debentures, and giving the Liquidator liberty to apply to the Court from time to time as to the payment of the moneys coming into his hands.

The Water Supply of Newcastle.—Mr. Riley Lord informed his colleagues at the meeting of the Newcastle City Council last Wednesday, that the Water Company had 1675 million gallons of water in store on June 29; being 230 million gallons less than the quantity in store on the corresponding date of 1894. This large decrease, together with the fact that the total quantity in store was now only a little above the quantity in 1893, when there was such a great scarcity, made it imperative that the utmost economy should be exercised in the use of the water. The Water Company commenced to pump water from the Tyne for trade purposes on the 1st inst. The consumption of water per day—18¾ million gallons—was 2 millions more than the normal quantity; and the Water Company were taking steps to find out where the leakage was. Subsequently, Mr. Lord proposed the adoption of the report of the Gas and Water Committee, who recommended that Mr. Mansergh be requested to complete his report upon the water supply of the city. They were bound, he said, to look to the future with regard to the water supply. The Water Company were now proceeding with the Reed scheme; but seven years or more would probably elapse before its completion. He thought they might take it that before then some effort would have to be made, in order to ascertain where their next supply would come from after the Reed scheme had been completed. They had never had a report from an expert on the capacity of Northumberland to supply the city with water; and the cost of such a report would be between £300 and £600. It was thought by one member that this would be a waste of the ratepayers' money; and another said it was not for the Council to tell the Water Company where water was to be found. The voting being equal, the report was not adopted.

MISCELLANEOUS NEWS.

NOTTINGHAM CORPORATION GAS SUPPLY.

Annual Reports of the Gas Committee and the Engineer.

The Gas Committee of the Corporation of Nottingham have issued their report on the working of the undertaking during the year ending March 31 last. It is signed by the Chairman (Mr. Alderman Barber), and is accompanied by an abstract of the receipts and expenditure up to the date named, as certified by the Accountant Auditor (Mr. H. E. Hubbart), as well as by the report of the Engineer and Genera Manager (Mr. W. R. Chester, M.Inst.C.E.).

The Committee remark that in their previous report they had to record a winter of exceptional mildness, with an unusual amount of sunshine and a remarkable absence of fogs; the combined result being a diminution of nearly 11 million cubic feet in the quantity of gas sent out, as compared with the year 1892-3. This time they have to deal with an entirely different condition of things—a winter of extraordinary severity, with intense and prolonged cold. The consumption of gas consequently largely increased; the total output being 1,474,368,000 cubic feet, as against 1,391,753,100 cubic feet—an addition of 82,614,900 cubic feet. Of this no less than 47 millions were sent out in the last quarter of the year. The Committee attribute the whole of the increase to the unusual severity of the frost which prevailed for seven weeks out of the thirteen constituting the Lady-day quarter; the gas being very freely used during that time for heating purposes. This is shown by the extraordinary demand for gas during the daylight hours, which was 29 per cent. more than in the previous year; while the gas sent out during the dark hours only showed the very moderate increase of 6 per cent. Of course, complaints were received at the Gas Offices, and some appeared in the local papers, from consumers with regard to the increase in their gas bills; but in every case these had the most careful attention of the officers of the department, and no pains were spared to show how this had arisen. The net profit for the year was £30,341 14s. 8d., as compared with £21,855 4s. in the previous year, or an increase of £8486 10s. 8d. The Committee have already paid over to the Finance Committee £2096 10s. 1d. out of the year's profits; and this, together with £21,903 9s. 11d. previously paid, raises to £24,000 the amount contributed by the department for the past year.

In the course of his report, Mr. Chester states that the plant at the various works was kept in good condition, and its efficiency fully maintained, during the year. At the Eastcroft works, the enlargements and renewals were completed; and the whole of the modernized plant worked throughout the past winter with very satisfactory results. At Basford, plant has been put down, in connection with the new retort-house, for conveying the coke direct from the retorts to the outside of the house, where it is quenched, elevated, sorted, and distributed by mechanical means into separate overhead hoppers, from which it can be loaded either into railway waggons or carts. For many years a very profitable business has been done in preparing, washing, and sizing coke for smithy and other purposes; but the new appliance places at the disposal of the Committee an additional size of coke specially suited for domestic use, which can be supplied without the extra cost of preparation which the cut and washed coke has to bear. This plant has been at work for several months with entirely satisfactory results. Further installations of regenerator furnaces have been completed; and rather more than half of the retort power has now been converted to this system. The modifications are effected out of revenue—a section of retorts being completed each year. At the Giltbrook Chemical Works, additional storage-tanks for naphtha and creosote have been provided, and other modifications have been made to meet the requirements of the Alkali, &c., Works Regulation Act and the Local Government Board Inspector. Some considerable extensions have been made to the distributing plant during the year, with the object of facilitating the supply of gas from each of the works, and enabling the various districts to be served from any two of the works, should one become disabled by accident. The severe frost of the past winter brought with it, in addition to a large increase in the consumption of gas, a number of serious and somewhat unusual troubles to the distribution department. The number of complaints as to frozen meters, services, and public lamps increased by 10,000 individual cases over the figures of the previous year; and in addition to these, the frost penetrated the ground to such an extent as to cause the fracture of no less than 40 mains, ranging from 8 inches in diameter downwards. These fractures resulted in considerable loss of gas; and they might have caused other troubles of more serious importance, which, however, the Committee fortunately escaped. The concreted foundation on which the pavement of many of the streets is laid compelled the gas to find an outlet to the surface very often long distances away from the fracture; and thus increased the difficulty of promptly making good the escape. The average illuminating power of the gas for the year was 18·69 candles; and the sulphur compounds were kept down to 16·70 grains of sulphur per 100 cubic feet of gas. With regard to distribution, the total mileage of mains at the close of the year was 282·75; there having been 2·66 miles added during the twelve months covered by the report. The number of meters fixed to March 31 last (including 321 lamp meters) was 39,203; being an increase of 471 on the previous year. Of these, 37,005 belong to the Gas Department, and 2198 to the consumers. The demand for prepayment meters increases. At the end of the financial year, 2193 of these meters were in operation; being an increase of 872 on the previous year. There were 949 new services laid, compared with 1039 in the previous year. The application of gas for trade and domestic purposes, other than for lighting, continues to increase. There are at present in use about 3650 gas-stoves, 4260 gas-fires, and 256 engines, besides a large number of other appliances of almost every description, which have not been numbered. Of the 3650 cookers in use, 3300 are rented from the department.

The accounts accompanying the reports show that, at the close of the financial year, a net sum of £923,169 had been expended upon the gas undertaking (£12,667 in the past twelve months) out of the £929,919 raised; leaving an unexpended balance of £6750. The revenue from the sale of gas amounted to £178,224; from the hire of meters and stoves, £7417; residuals produced £52,412; and sundry receipts made up a total of £241,567. The manufacture of gas cost £130,929 (coals figuring for £81,943, and wages for £23,936); its distribution, £17,079; management expenses were £6122; and the total expenditure was £163,870—leaving a balance of £77,697 to go to the profit and loss account. After paying £42,754 for interest, &c., carrying £500 to the capital account, for depreciation of gas-stoves, and adding to the sinking funds, there was a balance of £30,342—being the net profit for the year. Appended to Mr. Chester's report are analyses of the gas accounts for the past and the preceding year. In 1893-4, the amount expended for the manufacture of gas worked out to 18s. 7·18d. per ton of coal carbonized, and to 1s. 11·35d. per 1000 feet of gas sold; whereas last year the figures were 17s. 4·42d. and 1s. 9·31d. The total expenditure was at the rate of 22s. 7·72d. per ton of coal and 2s. 4·42d. per 1000 cubic feet of gas sold in 1893-4, as compared with 21s. 8·86d. and 2s. 2·67d. in 1894-5. The gas sold and meter and stove rents produced at the rate of 24s. 4·81d. per ton of coal carbonized and 2s. 6·63d. per 1000 cubic feet of gas sold in 1893-4; the residual products yielding 7s. 0·94d. and 8·88d.—the total receipts being 31s. 11·03d. and 3s. 4·06d. Last year the sales and meter and stove rental yielded at the rate of 24s. 7·51d. and 2s. 6·22d.; residuals, 6s. 11·43d. and 8·53d.; and the total receipts were 32s. 0·54d. and 3s. 3·32d. The following are the carbonizing results for the two years: 1893-4.—Coal carbonized, 145,569 tons; gas made, 1,483,932,000 cubic feet; gas sold, 1,391,753,100 cubic feet; gas unaccounted for, 92,178,900 cubic feet; or at the rate of 6·21 per cent. 1894-5.—Coal carbonized, 150,769 tons; gas made, 1,574,686,000 cubic feet; gas sold, 1,474,368,000 cubic feet; gas unaccounted for, 100,318,000 cubic feet, or 6·37 per cent.

COVENTRY CORPORATION GAS UNDERTAKING.

The Disposal of the Profits.

In the report which the Gas Committee presented at the meeting of the Coventry City Council on May 31, it was proposed that of the net surplus profits for the year 1894-5, amounting to £5600, £2500 should be paid into the sinking fund; leaving available for the relief of the district rate assessment £3100, which was equivalent to 6d. in the pound. The portion of the recommendation referring to the £2500 was referred back to the Committee for reconsideration. Reporting upon the subject at last Tuesday's meeting, they said: "The sinking funds, established for the repayment of the capital borrowed for the purchase of the undertaking, mature in sixty years from the date of their establishment. But there is a small sinking fund (No. 3) established for the repayment of the sum of £1523, borrowed for the expenses of promoting the Act sanctioning the purchase of the gas undertaking, which matures in twenty years from its establishment—*i.e.*, in 1906. The amount in this fund is now £659 14s., leaving £863 6s. to complete it. Your Committee recommend that of the above sum of £2500, £863 6s. be paid into sinking fund (No. 3), enabling it to be closed, and that the balance of £1636 14s. be handed over to the general district fund. This will make the total amount paid into the general district fund for the past year, £4736 14s." Mr. Andrews, in moving the adoption of the report, said that personally he had not altered his opinion as to the policy recommended in the first report. The remark was made when it was considered on a former occasion that they were not bound to do anything for posterity, for posterity had not done anything for them. He would point out that posterity had undertaken to do a great deal for the present generation. They had undertaken to pay nine-tenths of the cost of the gas-works, or, rather, the present generation had saddled posterity with that burden; and it was owing to this that they were now able to have cheap gas, and also the annual surplus to relieve the district rate. He should have himself preferred to see the City Council adopt the former recommendation, because he believed it would have been the safer, sounder, and indeed the nobler policy. The Gas Committee had, however, deferred to the opinion of the Council in their present recommendation. Mr. Haywood seconded the motion. Alderman Tomson quite concurred in the recommendation; saying he thought it only wise that they should pay off the fund. He congratulated the Committee on the very handsome profit they had made, which the Council accepted with great pleasure. The report was adopted.

BRIGHOUSE CORPORATION GAS UNDERTAKING.

In last week's issue, a paragraph appeared recording generally the result of the working of the Brighouse Corporation Gas Department during the year ending March 25 last. A detailed statement of the expenditure and receipts has since been received; and we give the items, omitting shillings and pence: Stock—coal, residual products, fittings, &c., £1072; manufacture of gas, wages, &c., £5281; maintenance of works and plant, £1265; fittings and meters, £454; manufacture of sulphate of ammonia, £392; establishment charges, £1074; instalment of loans, £1115; interest and repayment of loans, £968; discount off gas-rents, £763; sundry creditors, £1466—total, £13,851. Receipts: Sundry creditors to March 25, £1169; gas and meter rental, &c., £8902; residual products, £1517; sulphate of ammonia, £504; gas for public lighting, at 1s. 6d. per 1000 cubic feet, £584; stock—coal, &c., £319; residuals (500 tons of sulphate at £10 per ton), &c., £846; fittings, £195; meters, £469; payments for establishment charges, £85; making a total of £14,592. In moving the adoption of the minutes of the Gas Committee at the last meeting of the Town Council, Alderman Sugden said the accounts showed a profit of £740 on the year. The establishment charges had been entered at more than their proportion, which, of course, would make the profit larger. Then as to the cost of the public lamps, 1s. 6d. per 1000 cubic feet was 10d. less than the price they had to pay for the lamps in Rastrick; so that if they charged the same price in Brighouse as in Rastrick, there would

have been about £300 extra to add to the balance. Regarding sulphate of ammonia, although it was reckoned at £10 per ton, they were almost certain to realize £12; and this would make an additional £110. So that altogether, instead of a profit of £740, they had at least a profit of £1000. He thought they might safely say that the department, considering everything, had done very well. Of course, they were forced to admit that for two years in the history of the works there was a loss—one year when the price was lowered, and the other when coal rose above 100 per cent.; but this year, although the price had only been advanced for three months, they had made a very handsome profit. Alderman Sugden cited further figures to show that, although 5,389,300 cubic feet of gas more than in 1894 had been made, 178 tons less coal had been consumed. This showed that the money laid out was recouping itself. During the year two mortgages had been paid off—one of £1300 and another of £800; and this would save £208 a year. The debt on the gas-works was, in round figures, £26,000. But they had been valued this year at £80,000; and he reminded the members that the £54,000 balance had not come out of the rates. It had simply been taken from the profits of the department in the past; and at the price they were at present charging, they would go on adding to those profits, and paying off the debts, so that the gas-works in the future as in the past would prove a very profitable undertaking to the Corporation. The minutes were passed.

LARGE GAS-WORKS EXTENSIONS AT WALLASEY.

In the presence of several members of the Wallasey District Council, officials, and others, the extension of the gas-works at Poulton, and a new refuse-destructor, erected on the same site, were formally opened last Wednesday. The extent of the land on which these works stand is 52,300 square yards. The new retort-house (which has been completed) contains 188 retorts, capable of producing 750,000 cubic feet of gas per twenty-four hours. The building has been erected on a plan which permits of the number of retorts being doubled should the necessity arise. Adjoining the retort-house is a boiler-house containing two Lancashire boilers. In the same building are the men's room, lavatories, &c. The annular condensers are twelve in number, 28 feet high, and 4 feet external diameter. There are two exhausters, with steam-engine to each. Adjoining the exhauster-house is a pump-house containing steam, tar, and liquor pumps, and a battery of circulating pumps. The tower scrubbers are two in number, 30 feet high and 12 feet in diameter, with improved distributors and machinery-room. The purifier-house contains four purifier-boxes, fitted with Weck's patent valve. The mains throughout the works are 20 inches in diameter. There are also iron tar and liquor wells. The whole of the levelling, draining, and railways, and the erection of buildings and office alterations have been carried out by Messrs. Lawrence Marr and Son, of Liverpool. The retort-bench fittings, condensers, and tower scrubbers are by Messrs. W. C. Holmes and Co., of Huddersfield; the exhausters and pumps, by Messrs. George Waller and Co., of Stroud; and the purifiers, by Messrs. C. & W. Walker, of Donnington, near Newport.

The opening ceremony was performed by Mr. W. G. Ellery, the Chairman of the Gas and Water Committee; and the party present were conducted over the works by Mr. J. H. Crowther, the Gas Engineer. In formally declaring the gas-works open, Mr. Ellery said the old works were constructed in 1861 at a cost of £15,000. Since that time the consumption of gas in the district had doubled itself every ten years; and recently it became necessary to extend the plant. The Gas Committee decided to enter upon an expenditure of £100,000. But some of the ratepayers thought it wise to curtail this amount; and it was agreed for the present only to spend £50,000 in the extensions. They did not, however, extend the works one day too soon, because the consumption of gas for the year ended March 31 last was 182,428,500 cubic feet. It must be a supreme satisfaction to their former Engineer (Mr. H. Ashton Hill) and Mr. Crowther that the works had been completed in such a short time, and had not exceeded by a penny the estimated expenditure of £50,000, although the Committee had considered it advisable to build the retort-house sufficiently large for the requirements of the original £100,000 scheme. All the other works had been carried out with equal efficiency; and it afforded him the greatest pleasure in declaring them open. The visitors afterwards drove to New Brighton, where dinner was partaken of at the Victoria Hotel.

ELECTRIC LIGHTING NOTES.

The Gas Committee of the Belfast Corporation have made a further grant of £5000 to the Electric Lighting Committee. Some main extensions are in contemplation by the latter, who report that they have now 6500 lamps in use, and the only thing they are not quite satisfied with is the fact that the manufacturers within the district have not made use of the power at their disposal.

Gas-meters are frequently charged by consumers with capricious conduct; and it appears that, in the eyes of some, electric meters are not altogether blameless. One of the customers of the Portsmouth Electric Lighting Committee—a Mr. F. Edwards, of the Wiltshire Lamb, Southsea—has been summoned for £5 alleged to be due for 36 days' supply of electricity. His defence was that the light had only been used for ten days; and it was suggested that the meter had continued to register, although no current was passing. It was also pointed out that a workman had disconnected the meter, and taken it to the office, instead of an inspector calling to examine it; and it was contended that the pointers might have shifted on the dials in transit, or that the wrong meter might have been returned to Mr. Edwards. The case was adjourned, in order that expert evidence might be called.

The Portsmouth Electric Lighting Committee have accepted a tender of Messrs. Ferranti for the elaborate extension of mains that has been resolved upon. The figure is £7619; but, of course, the Committee's decision will have to be endorsed by the Town Council. Messrs. Ferranti were the contractors for the original work.

THE NEW WATER-WORKS FOR BILSTON.

Last Friday week, the memorial stone of the new water-works buildings of the Bilston District Council was laid by Mr. T. Holcroft, who is one of the oldest of the leading men of the district, and has given unremitting attention to this important scheme. The Engineer of the works is Mr. Baldwin Latham, who presented to Mr. Holcroft a silver trowel, which he used in the laying of the stone. The water supply is at present provided by the Corporation of Wolverhampton, who derive from the district £3500 a year. Before resolving to sever the contract with the neighbouring borough, the Bilston authority entered upon careful investigations, and were fortunate, after making trial borings at the Bratch, in discovering that water in abundance and of undoubted quality could be secured. A well has since been sunk to a depth of 150 feet, from which, it is stated, above a million gallons a day have been lifted, while the permanent overflow, without any pumping, has been between 160,000 and 170,000 gallons a day. The reservoir, which has been completed and is ready for the reception of water, is on Goldthorn Hill at Wolverhampton, and consists of an underground chamber, built almost entirely of concrete, 116 feet long and 106 feet wide, with a water-level 12 feet deep. The reservoir is covered by a series of concrete arches, 10 feet in span, which are supported by walls 2 feet thick, and archways to allow of the circulation of the water. It is provided to hold 750,000 gallons of water, or sufficient for a day-and-a-half's supply. The works at the Bratch consist of the well, engine-house, boiler-house, workshop, and pump-room. The buildings are being erected by Messrs. H. Willcock and Co., of Wolverhampton; and they are of a very ornamental character. The contract for the machinery has been taken from the original contractor, and placed in the hands of Messrs. Thornewill and Warham, of Burton-on-Trent. Two triple-expansion engines will be laid down; and it is anticipated that each of them will be capable of raising and forcing to Goldthorn Hill a million gallons of water per twenty-four hours. Nearly £3500 has been expended in sinking the well; and the reservoir has necessitated a similar outlay, while the engine-house and other buildings will cost about £6000. To these sums will have to be added the expenses of laying down the pipes from the Bratch to the reservoir (about four miles in length), and the cost of the engines and other items. In addition, there will be the payment of an agreed sum to the Corporation of Wolverhampton for relinquishing their contract to supply Bilston with water, and the value of the mains hitherto used in Bilston township by that body. The reservoir has been constructed by Mr. H. Hill, of Maidenhead; and the well, by Mr. John Hughes, of Dudley. It is expected that the distribution of water from the new works will be commenced in about a year's time.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

This week the Edinburgh and Leith Gas Commissioners appeared before the Dean of Guild Court, to answer to the charge of proceeding to erect a temporary chimney at the Edinburgh Gas-Works without the warrant of the Court. The Procurator Fiscal moved for damages and costs. Mr. Waterston, one of the Commissioners, explained that the fact of the present stalk having gone some five feet off the perpendicular got into the newspapers, and caused a perfect uproar among the people in the district. Perhaps the Commissioners had been a little too hurried in proceeding with the work; but it was done entirely in the public interest. Dean of Guild Miller pointed out that the Court was a special court of urgency; and a meeting could have been held on very short notice. People surely knew they were going to build the day before they dug out the foundation. He imposed a fine of five guineas, with costs. The Commissioners, having purged their offence, may now proceed with a clear conscience to the remedying of the defect in the foundation of the tall chimney.

A managing director of one of the Scotch oil companies, calculates that there will be a loss to the companies on sulphate of ammonia this year, as compared with last year, of £75,000; but that there will be a gain of £120,000 on burning oils, £15,000 on naphtha, £20,000 on gas oils, and £85,000 on candles—making a total gain of £240,000, and a net gain of £165,000. This throws some light upon the prospects of oil-gas making. The rise upon gas oil, as it is called, is, according to this estimate, equal to 1¼ farthings per gallon, or 7s. per ton. As the price of these oils has been about £2 10s. per ton, the rate now should be about £2 17s. Mr. Linton, of Leith, in his report in April, 1893, estimated that the limit of price at which the manufacture of gas from oil would become unprofitable would be between 70s. and 80s. per ton; so that there is still a considerable margin left in favour of oil.

It is reported (but the details have not yet come to hand) that the revenue in connection with the Paisley Corporation Gas-Works for the past year amounted to £40,815. The expenditure was £30,481; leaving a balance of £10,334. From this, there required to be paid £2913 for sinking fund, interest on mortgages, &c., leaving a profit of £7421 on the year's transactions.

The Bothwell and Uddingston Gas Company, which is managed by Mr. L. Hislop, last year reduced the price of gas from 3s. 9d. to 3s. 6½d. per 1000 cubic feet, and abolished meter-rents; and the result of this, together with the increased cost of coal and higher taxes, was that the balance of revenue for the year just closed was £760 less than the sum reported a year ago. The amount was £1747; and this sum, with the balance brought forward a year ago, enabled the Company to write off £319 for depreciation, to add £590 to reserve fund, and to pay their customary dividend of 10 per cent.—carrying forward £1085. There was an output of gas of 26,694,000 cubic feet—a gratifying increase of 588,000 cubic feet, which accounts for the Company maintaining their financial position. The severe weather of the past winter told its tale, as in other places, by an increase in the leakage, which rose from 6·7 to 7·6 per cent., still a very moderate quantity in a district which is riddled with coal-pits. On account of the yearly increasing consumption of gas, the Company are about to erect a new retort-house, with

improved benches, the designs for which have been prepared by Mr. Hislop; and to create £3000 of additional capital. At the annual meeting of shareholders the other day, Mr. Hislop was congratulated on his year's working.

The Galashiels Gaslight Company had an output of gas last year amounting to 55,870,900 cubic feet—an increase of 3,645,600 feet on the previous year; and a leakage of 1,393,173 cubic feet, which is less than 2½ per cent. Last year the Company reduced the price of gas from 3s. 6½d. to 3s. 4d. per 1000 cubic feet; and the profit for the twelve months has been reduced from £2104 to £1869. There was a total revenue of £10,278, of which £8835 was from gas, and £1304 from residuals. The profit for the year would have been larger, but for an extra outlay of £102 in consequence of the strike of miners, the expenditure of £155 upon a hydraulic main, and compensation which was paid for two accidents. With regard to the accidents, it was explained that in one case the insurance company declined to meet the claim; but they agreed to give a gratuity to the widow, to which the Directors made a contribution. In the other case, some boys had pushed a companion into an excavation, which was followed by a claim for £100; but the claim was compromised. In future, the Company have resolved to pay a little more insurance premium, in order that no claim shall be called in question by the insurance company. The Company have also laid in a large stock of coal, to be in a position to meet any future strikes. This latter is a sensible policy; and it could not have been adopted at a more favourable time. It is not likely that coal will long remain at its present low price. The Company are well pleased with the past year's working, which enabled them to earn the usual dividend of 10 per cent.

Among the smaller gas undertakings, the following may be noticed: The Motherwell Gas Company had an increased output of gas last year to the amount of 7 per cent. They have paid a dividend for the year at the rate of 8 per cent. The Hawick Gas Company last year sold rather less gas than they did in the preceding twelve months; but they have paid their usual dividend at the rate of 10 per cent. The price of gas has been continued at 3s. 6½d. per 1000 cubic feet. The Coupar Angus Gas Company have paid a dividend for the past year at the rate of 6 per cent. The price of gas has been reduced by 5d. per 1000 cubic feet; making it 6s 0½d. per 1000 cubic feet. The Pittenweem Gas Company have paid a dividend at the rate of 10 per cent., and continued the price of gas at 4s. 2d. per 1000 cubic feet. The Brechin Gaslight Company have paid the same dividend as last year—25s. per share; and have continued the price of gas at 4s. 7d. per 1000 cubic feet. The Directors are dissatisfied with the profit which was made. They ought to set about enlarging the town, as it is impossible to earn an increasing profit in a decaying, or a stationary community. They also seem to forget the loss of gas through pipes damaged by the steam road-roller. The Crieff Gas Company have paid their customary dividend of 10 per cent. for the past year; the price of gas to remain at 4s. 2d. per 1000 cubic feet. The Pitlochry Gas Company had an increased output of gas last year of 135,000 cubic feet; and in view of the advance in the price of burning oils—and taking into account also, I suppose, the capabilities of the place for extension—the Directors have resolved to apply for a feu of half an acre of land adjoining the gas-works, upon which extensions may be built. It almost sounds ludicrous to acquire so much for so small a concern; but if the Company think they can bear the burden, they will undoubtedly get the land cheaper now than they would at any future time. They have paid a dividend at the rate of 5 per cent. for the past year.

Monifieth is at present a burgh in search of light. Taking advantage of the amended General Police Act, the community had their little town last year created into a burgh. Having acquired the powers of a burgh council and magistracy, with their advantages, they are face to face with the responsibilities of their new position. One of these is the lighting of the burgh—that is, of the public thoroughfares; but "what is sauce for the goose is sauce for the gander," and the light which is suitable for the streets will also be suitable for the inhabitants. Accordingly, the ratepayers were called together on Thursday night, to consider what scheme should be adopted. There was a large attendance, which is a healthy sign. The suggestions put forward were: First, the procuring of a supply of gas from the Broughty Ferry Gas Commissioners; second, the erection of local gas-works; and, third, the construction of an electric lighting installation. Mr. Barrie, the Convener of the Lighting Committee, said that the Broughty Ferry Commissioners had offered to supply Monifieth with gas at the boundary of the burgh at the same price as they charged the ratepayers within their own district. He calculated the price of laying the pipes through Monifieth at £1600. The idea of local gas-works was next alluded to; and he was of opinion that works such as would be suitable for Monifieth could be put in operation for £2500. Mr. Barrie referred to the erection of an electric station at Milton, taking advantage of Dighty water for the motive power; and he said he was of opinion that this could be done at a cost of £5000. After a general discussion, it was agreed that the matter be delayed for nine months; and that in the meantime the Commissioners approach the Broughty Ferry authorities asking them to lay pipes, put in meters, &c., and supply gas to Monifieth at 1s. per 1000 cubic feet above the price paid by householders within their own boundary.

The Dunbar Gas Commissioners seem to be mending their ways; and I am glad to see it. On Friday of last week, the whole of the Police Commissioners were invited to the gas-works to inspect them. This step was taken on account of the fact that, at one of the former meetings at the works, suggestions were made by some of the Commissioners; and these having been now executed, it was thought right that the Commissioners should see what had been done. Everything, it is stated, was found in excellent order. The new Manager (Mr. Richmond), who was appointed last January, would appear to have been very diligent; for he has not only had the whole of the plant made tidy and respectable, but every piece of spare ground in the works has been converted into a flower or vegetable garden. The Commissioners were highly pleased with the appearance of the works, and congratulated the Convener and Manager on the state of affairs. Let us hope this is the opening of a new era of peace. I am afraid the Commissioners need scarcely look for brilliant results from the gas-works, because they are so far from the railway station that carting charges must be heavy. They are not a great distance from the railway; and a siding to the works would not cost very much.

The Dundee Town Council on Thursday approved of estimates for the current year, which provide for a revenue of £49,082, and a surplus of £125. The water rates have been fixed at the same as last year—1s. 1d. per pound for domestic purposes, and 1d. per pound for public purposes.

In a report which has been submitted by Mr. G. D. Macdougald, the City Analyst of Dundee, regarding the filtration of the water from Lintrathen and Monikie, it is stated that experiments were carried out in a special filter from last summer till the end of May. The results were that in the Lintrathen water the highest number of bacteria registered in unfiltered water was 500 per cubic centimetre, and the lowest 24. In Monikie unfiltered water, the highest number registered was 8938 bacteria per cubic centimetre, and the lowest 80. In the case of the Lintrathen water, there is practically no chance of objectionable matter reaching the water after it has left the loch, where natural purifying processes are constantly at work; but in the case of Monikie water, there is, under certain circumstances, more or less serious pollution taking place at the Gagie aqueduct. On Feb. 27 a sample at the Monikie end gave 2272 bacteria per cubic centimetre; and at the city end of the aqueduct, the number had risen to 3606. It is therefore evident that a large amount of land water, or material rich in bacterial life, enters the aqueduct through its walls. Mr. Macdougald recommends that the water-way from the Monikie ponds to the city should be made tight; that provision be made for the filtration of Monikie water at the rate of 450 to 700 gallons per square yard per day; and, although not so urgently required as the above, that provision be made for the filtration of Lintrathen water at the rate of 600 to 800 gallons per square yard per day.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July 6.*

Sulphate of Ammonia.—Throughout the week the market has been quiet; the tendency of prices being rather in buyers' favour. Prices are somewhat irregular; but the value may be quoted at about £9 12s. 6d. per ton. The production at this season is small; but there has been rather more offering by makers; while, on the other hand, the requirements for home consumption are just now very limited, and the demand for export only on a moderate scale. The price reached is, however, approaching a tempting level; and a little further concession would probably induce a very considerable amount of buying. Dealers continue to offer for forward delivery at a moderate premium upon spot value; but makers generally, hoping for better prices later, are still shy about offering ahead.

Nitrate of Soda is steady but quiet; and spot value is 8s. 3d. per cwt.

LONDON, *July 6.*

Tar Products.—A somewhat languid feeling prevails in this market. Creosote and common oils are realizing poor values, and look as if they are being produced in excess of requirements. There is a moderate demand for carbolic acid products, which is likely to increase as the summer develops. A very little more inquiry is said to exist for solvent for foreign consumption; but the price is exceptionally low. Pitch is firm at rates quoted below: but no important new business has been reported. Prices: Tar, 17s. to 21s. Pitch, 35s. to 37s. 6d. Benzols, 90's, 1s.; 50's, 11½d. Solvent naphtha, 1s. 0½d. Toluol, 1s. 0½d. Crude, 30 per cent. naphtha, 4½d. Creosote, liquid, 1½d.; ordinary, ¾d.; salts, 18s. Cresylic acid, refined, 1s.; brown, 10½d. Carbolic acid, 60's, 1s. 5½d. Anthracene, nominal, "A quality," 1s. 1d.; "B," 10d.

Sulphate of Ammonia appears to be utterly demoralized. Notwithstanding the small production which is now going on, during the past week values have continually receded; and, although little or no business has been done, prices have ranged between £9 10s. and £9 15s., less 3½ per cent., according to terms and port of shipment. Gas liquor is quoted at 7s. to 8s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—With one or two exceptions, the principal gas-coal contracts of this district are now practically settled; and one of the largest Lancashire colliery companies is reported to have secured the bulk. In fact, a representative of a large competing colliery told me on 'Change that the Company above referred to had practically swept the decks; having gone in at low competing prices, to secure all the business possible. The basis of prices on which further contracts have been settled remains very much what I have reported previously; and the average for this season's contracts may now be taken at about 6s. 6d. per ton at the pit for good Wigan four-feet and 7s. for partially screened, or what may be really termed through-and-through, good Arley mine coal. These prices represent quite 1s. below what was got last year for gas-coal contracts. In the general coal trade, business continues extremely limited in weight; and with collieries in most cases only working three days, supplies of round coal are hanging upon the market. House-fire qualities are necessarily only meeting with the most limited demand. Prices, however, for these are nominally unchanged, at 10s. to 10s. 6d. per ton at the pit for best Wigan Arley, 8s. 6d. to 9s. for seconds Arley and Pemberton four-feet, and 7s. to 7s. 6d. for common house coal. But it is only on very small hand-to-mouth sales that these figures are being got. The lower qualities of round coal are in but slow request for iron-making, steam, and general manufacturing requirements; and supplies are in excess of the demand, with prices, consequently, cut very low to secure orders—6s. to 6s. 6d. per ton being the full average figures for ordinary steam and forge coals. Engine fuel moves off without difficulty; collieries, in some cases, owing to the limited demand for round coals, being short of supplies of slack to meet customers' requirements. Buyers have, however, no difficulty in obtaining what they want in the open market; and prices are not more than maintained at 3s. to 3s. 6d. per

ton at the pit for common slack, to 4s. 6d. and 5s. for better qualities. For shipment, business is quiet, with no improvement in prices, which remain extremely low; common steam coal being obtainable at 7s. to 7s. 6d. per ton, delivered at the ports on the Mersey.

Northern Coal Trade.—There has been an increase of the demand for steam coals in the last few days; the exports having been enlarged. There has also been a slight increase in the shipments of gas coals to London, now that the new contracts have begun; so that in both parts of the coalfield of the North, the change is for the better. Best Northumbrian steam coals are steady at from 8s. 9d. to 8s. 10½d. per ton f.o.b.; and there is rather fuller work at most of the collieries than there has been of late. Second-class steam coals are still rather quiet at from 8s. to 8s. 6d. per ton; and steam smalls are unaltered at 3s. 6d. In regard to gas coals, the demand has been slightly better since the turn of the half year, and must now be expected to improve. The large contracts for the year are about concluded; and the price has been so much reduced that the gas companies should profit considerably. For odd cargoes, the rates vary from 6s. to 6s. 6d. per ton f.o.b. There is a steady demand for manufacturing coals; but the price shows no alteration, though one or two collieries have a very strong demand for smithy coals. After the broken time at the pits, through the recent local holidays, there is now a steadier production, concurrent with a fuller demand, though for gas coal the latter is still far below the average. The coke trade has felt the benefit of an increased demand for the north-western furnaces; more being now in blast in West Cumberland. The exports of coke do not very materially vary; and the price is maintained at from 13s. to 14s. per ton f.o.b., for best Durham coke, other kinds being obtainable at as low as 12s. 6d. per ton. Gas coke is quiet; but there is now a limited output, and the prices are unaltered this week.

Scotch Coal Trade.—The demand still continues at a low ebb; and little improvement is expected until about the middle of next month, by which time most of the tradesmen will have had their holidays. Even then, however, it is not expected that there will be much advantage to the coal trade, as it is well known that many users of coal have been taking advantage of the low prices to lay in stocks, and that stacking has also taken place to a large extent at pit heads. An improvement in the foreign demand was expected about this time; but it has not yet come, and, all over, the trade appears yet to be a waiting one. The prices quoted are: Main, 5s. 9d. to 6s. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s.; splint, 6s. 3d. to 6s. 6d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 164,802 tons—an increase on the previous week of 19,809 tons, and on the quantity in the corresponding week of last year of 86,158 tons. For the year to date, the total shipments have been 3,287,595 tons—a decrease on the same period of last year of 306,016 tons.

Extensions at the Halifax Gas-Works.—Last Wednesday, the Gas Committee of the Halifax Corporation were authorized by the Council to expend £10,000 upon improvements at the gas-works. The following are the detailed items: Boiler and house, £1000; exhausters and house, £1000; washers, £2000; purifying-house, £1000; new purifiers, £3000; station meter and house, £1000; and connecting-pipes, &c., £1000.

The "Penny-in-the-Slot" System at Burnley.—At the last meeting of the Burnley Town Council on Wednesday, Alderman Collinge, the Chairman of the Gas Committee, expressed his satisfaction with the working of the "penny-in-the-slot" gas-meters. He said that the Gas Department had about 500 of these meters out, and there was an increasing demand for them from the poorer classes of people. He added that, though there were so many in use, he had not heard of any irregularities in the registration.

The Darwen Corporation Gas and Water Undertaking.—The Darwen Borough Treasurer (Mr. J. H. Ellison) has issued his annual abstract of accounts. Dealing with the Gas Department, he states that the profit on the year's working was £3729, as compared with a loss of £158 in the preceding financial year. This satisfactory result, he adds, has been brought about by a decrease in the cost of coal, and an augmentation in the bulk of gas sold, together with an increase of 3d. per 1000 cubic feet of gas. The amount standing to the credit of the profit and loss account at the end of the year was £4499. In the Water Department, there was a loss of £379; and the sum of £826 has been carried to the debit of the profit and loss account for the current year.

Burglary at the House of Mr. W. R. Cooper, of Banbury.—Gas managers who live in fancied security from the attacks of burglars, from the fact of their residences being upon the works, and men and lights being about the place, will probably have that confidence shaken by a perusal of the following account of what happened at the house of Mr. W. R. Cooper, the Manager of the Banbury Gas-Works, on the night of the 30th ult. On his servant going downstairs on Monday morning last week, she found that drawers, &c., in different rooms had been ransacked, and she raised an alarm. On making an investigation, Mr. Cooper found that the office, front, and back doors had been opened, and that a candle had been used by the intruder in looking round the rooms. Some cooked food and some spirits had disappeared. Several coats hanging in the hall had been removed to the back door; and a large case of silver-plated goods was found on the copper near that door, having been taken from the sitting-room. The only property missed was a silver watch (No. 90,104) and a few postage stamps, which had been taken from the office. The police have ascertained that two of the men employed at the works, on leaving the retort-house about half an hour after midnight on Sunday, noticed a light in one of the downstair rooms of Mr. Cooper's house. One of them crossed the lawn to within a few feet of the front door, and saw a man moving about the room and carrying a light in his hand. But, strangely enough, the men do not seem to have attached sufficient importance to the occurrence to lead them to make further investigation; and neither of them is in a position to give a description of the burglar. The doors and windows of the house are stated to have been properly fastened on Sunday night; and it is believed that the thief must have secreted himself in the house before the family retired.

The Public Lighting of West Hartlepool.—In a report which has been prepared by the Borough Surveyor of West Hartlepool (Mr. J. W. Brown), he gives the cost of lighting the public streets according to the sizes of the lamps. Including gas, repairs, labour, &c., it averaged £2 1s. 6d. for the ordinary lamps, and rose to £14 9s. 9d. for the largest gas-lamps used. The total yearly cost is about £3000 for street lighting, spread over some 1400 lamps.

The Whittington District Council and the Gas-Works.—The Clerk of the Whittington District Council has, in compliance with his instructions, been in communication with the Directors of the Whittington Gas Company regarding the proposal to purchase their property. The Secretary of the Company (Mr. A. H. Ceaser) has informed him that the Directors have no desire to sell the undertaking. At the same time, if an offer were made to purchase at a reasonable figure, they would give the matter their consideration. The only condition would be a cash payment of the price agreed upon. The paid-up capital of the Company is £5000; and the dividends paid have reached 8 per cent. The Whittington Council have inquired of the Brimington Parish Council whether they would be willing to join in the purchase.

Unaccounted-for Gas at West Bromwich.—At the meeting of the West Bromwich Town Council last Wednesday, the Gas Committee reported that an honorarium of £20 had been awarded to the Outdoor Superintendent (Mr. W. H. Wayte) for extra services rendered during the severe frost of last winter, and also in consideration of the low percentage of unaccounted-for gas in the district. The Mayor (Mr. Alderman R. Farley), in moving the adoption of the report, referred to the careful manner in which Mr. Wayte attended to the distribution of gas, as shown by the prevention of waste. In this respect, West Bromwich occupied, he said, a remarkable position, and compared very favourably with all the other undertakings in the United Kingdom. The unaccounted-for gas in the whole of the undertakings averaged 6·97 per cent.; while in West Bromwich during the last few years it had been only 5·38 per cent. This would make a difference of more than £200 in the profits of the gas undertaking. The members would agree with him that the Gas Department was well looked after, and that in Mr. Wayte they had a good officer. The motion was carried unanimously.

Sales of Shares.—Shares in the *Wakefield Gas Company* were sold by auction last week at the following prices: £5 "B" 5th shares at £9 7s. 9d. each; £5 ordinary shares, at £11 6s.; and £10 shares (£4 paid), at £7 7s. 6d. Original £20 shares in the *Colchester Gas Company* have been sold for £42 apiece, and "B" £20 shares for £31 to £33. ——At Durham, some £5 shares in the *Hartlepool Gas and Water Company* were disposed of last week for £9 7s. 6d. each; and shares of a similar nominal value in the *Consett Water Company* realized from £8 7s. to £8 14s.——At Laker's Hotel, Redhill, last Wednesday, Messrs. Lees and Burchell, of Reigate, sold by auction some consolidated stock of the *Reigate Gas Company, Limited*, at the rate of £248 per £100 of stock—one lot of £50 of stock fetching £127; £5 fully-paid shares in the *Redhill Gas Company*, at an average of £13 each; stock of the *Reigate Water-Works Company, Limited*, at the rate of £186 per £100 of stock; shares in the same Company (£7 paid) at £18 10s. each, and ordinary fully-paid £10 shares in the *East Surrey Water Company*, on which the maximum dividend is 7 per cent., at £13 5s. per share. The total amount realized by the sale was £3835.

New Joint-Stock Companies.—The following new joint-stock undertakings have been registered: "Pintsch's Patent Lighting Company, Limited," with a capital of £60,000, in £5 shares, to adopt and carry into effect an agreement made between Pintsch's Patent Lighting Company, Limited (the old Company, now in liquidation), of the one part, and this Company of the other part, for the acquisition of the business of the Company, and also certain patents, patent rights, and inventions for improved means of lighting railway carriages, buoys, sea-lights, and for other purposes, and to develop and turn to account the same; and as manufacturers of, and dealers in, every description of appliances connected with the manufacture of gas or gas lighting. The "Town and Village Electric Light and Power Company, Limited," with a capital of £100,000, in 19,800 ordinary shares of £5 each and 1000 founders' shares of £1 each, to acquire as a going concern, and carry on, the business of supplying electric light, heat, and power, as now and hitherto carried on by the Western Counties Electric Light and Power Syndicate, Limited, at Kingswood, Gloucestershire, and Keynsham, Somerset, and, with a view to the foregoing objects, to adopt and carry into effect two agreements. "Levinstein, Limited," with a capital of £90,000, in £10 shares, to acquire all or any part of the business of Messrs. J. Levinstein and Co., Limited, the well-known chemical manufacturers.

Gas-Works Extensions at Bangor, Ireland.—The Chief Engineering Inspector of the Local Government Board for Ireland (Mr. C. P. Cotton, M.Inst.C.E.) inquired last Tuesday into an application for a loan of £4600 required for extensions at the Town Commissioners' gas-works at Bangor. The present plant, it appears, is insufficient to meet the continuously growing demands; and it is proposed that the public thoroughfares shall be more efficiently lighted than they now are during the winter months. The Town Clerk (Mr. F. Pollock) stated that gas was supplied at 4s. 9d. per 1000 cubic feet. The charge for ordinary street-lamps was calculated at £1 3s. 9d. a year; and for each of the large 80-candle power lamps, at £3 10s. each. They had had a number of applications for private lighting; but, owing to the insufficiency of the storage and inadequacy of the works, they had to be refused. The Gas Engineer (Mr. E. F. Bunyar) submitted plans of the contemplated additions to the works; and the Town Surveyor (Mr. Lamon) produced the plans of the proposed extended mains. Mr. Bunyar estimated the cost of the extension of the works at £3629; and Mr. Lamon, the cost of the new mains and lamps at £771. Mr. Danskin, the Gas Manager, gave evidence of the inadequacy of the present works, and read from a tabulated document a statement of the gas produced within recent years. The works, he mentioned, always produced a profit to the Board after defraying expenses and maintenance, and paying interest on loan and principal. Only one ratepayer appeared in opposition.

Reduction in Price.—The Directors of the Wandsworth and Putney Gas Company announce that the price of gas will be reduced from 2s. 6d. to 2s. 4d. per 1000 cubic feet after the taking of the meter-indices at the Midsummer quarter.

Improvements at the Chorley Gas-Works.—At the last meeting of the Chorley Town Council, the tender of Messrs. R. and J. Dempster for supplying and fixing three retorts on the Peebles system was accepted. In other ways the plant is being improved, so as to secure the best possible results and to meet the growing requirements of the Gas Department consequent on the increase of consumers.

Proposed Improvements at the Knaresborough Water-Works.—Last Tuesday, Colonel J. O. Hasted, R.E., held an inquiry at the Town Hall, Knaresborough, with respect to an application by the Knaresborough District Council for authority to raise £1800 for improving their water-works. The Clerk (Mr. T. Mainman) gave a history of the water undertaking, and explained that, owing to serious and continuous breakdowns—the last taking place early in the present year—it had been decided by the Council, on the advice of their Gas and Water Manager (Mr. T. Settle), to put down a turbine in place of the old water-wheel, erect an additional storage-tank, and lay a length of new main; and also to apply to the Local Government Board for permission to borrow £1800 for these purposes. Plans, specifications, and tenders had been obtained and submitted to the Board. The rateable value of the town in 1872 was £11,264; in 1895 (for water purposes), £11,050. The population was probably now about 5000. With regard to the water of the Nidd, the two last analyses showed it to be of "good quality and well fitted for drinking and general use." He went on to say that the Council had authority to raise £12,000, repayable in fifty years; but they had only borrowed £11,000. The Inspector remarked that it was a question whether the Local Government Board could sanction the borrowing of £1000 more without a Provisional Order. Mr. Settle then read a long and interesting report on the water-works; furnishing full details of the proposed improvement. The new turbine would, he said, develop 50 brake horse power with 3920 cubic feet of water per minute. It was guaranteed to develop from 65 brake horse power down to half power. The cost would be £428. The proposed new tank would contain about 900 tons, or 200,000 gallons of water, which, with the present storage, would give about three days' supply. The tank would furnish an additional pressure of 6·5 lbs. per square inch on the mains at its base, and would increase in direct proportion the pressures throughout the whole area of supply. The cost of the tank, to be constructed of steel, was £724, including a concrete bed 34 feet in diameter and 2 ft. 6 in. thick. The tank would be 50 feet high and 30 feet diameter. He concluded by dwelling on the benefits of a constant service, as compared with an intermittent one. Mr. W. Mason opposed the turbine scheme as the result of practical knowledge gained by more than 21 years' experience as mechanic and engineer in the mill where the town's pumps and the water-wheel were. He gave his reasons for his objections; and stated that if the existing wheel were put into proper repair, shielded round, and re-paved, it would be worth a dozen turbines in a dry summer, and would not take half the quantity of water to drive it, while it would cost £250 less to do it. He asked the Board to refuse their sanction to the application. After some further evidence, the inquiry closed; a vote of thanks being accorded to the Inspector, who was subsequently shown over the works.

The Scarcity of Water in South Wales; Proposed Purchase of the Ystrad Water-Works.—A resolution passed by the Rhondda Chamber of Trade respecting the drought in the Rhondda Valleys (which has been recently referred to in the JOURNAL) was presented by a deputation at a recent meeting of the District Council. The resolution asked that the Council should take immediate steps to force the Ystrad Water Company to discharge their obligations to the residents; and, if necessary, that an Inspector of the Local Government Board be requested to investigate the matter, so as to prevent a recurrence of the present "deplorable" condition of affairs. The matter was fully discussed by the Council after the deputation withdrew. It was stated that the Company had no water in store; and that their reservoir would only hold at the utmost 8 million gallons. It was also alleged that the Company had not carried out the undertaking according to the powers granted them by Parliament, although there was plenty of excellent water running to waste in the district. A suggestion was made by Alderman Matthias that a letter should be written to the Company stating that, as the Council were satisfied that the Company were unable and unwilling to supply the district with a reasonable amount of water, they desired an interview with the Directors, with a view of arranging for a proper supply, or, if the Company were willing, of purchasing the works at their value. A conference between representatives of the two parties accordingly took place last Wednesday week at Pontypridd. The Council asked that a reservoir should be constructed for the valleys of sufficient capacity for a two months' supply. The Directors maintained that the Company had done everything that could reasonably be expected of them to furnish the consumers with an adequate supply of water for domestic purposes. The members of the Council emphatically told the Directors that, unless the Company provided adequate storage, they would proceed without delay to construct a reservoir for the whole of the district supplied by them. The Directors, after further discussion, observed that they would not be able to give the Council a definite answer until a meeting of the full Board had discussed their demands. The Pontypridd District Council recently asked Mr. G. F. Deacon to take observations as to the quality and quantity of the water supplied by the local Company; and his report has been under the consideration of the Council. It included several important recommendations; and the Council have resolved to consult Mr. Balfour Browne, Q.C., as to their position with reference to the Company. The latter body are energetically pushing forward the construction of an additional reservoir (of 2 million gallons capacity) on the Mardy Mountains, the contract for which is in the hands of Messrs. J. Aird and Sons. In view of the rapidly decreasing area in Wales available as gathering-ground for the supply of water, and of the possibility of still further inroads being made by English corporate bodies, the Glamorgan County Council have appointed a Committee to report as to what steps, if any, ought to be taken for the conservation to the county of its watershed areas.

New Boiler for the Lymm Gas-Works.—The tender of Messrs. W. C. Holmes and Co., of Huddersfield, has been accepted for the Cornish boiler for the Lymm Gas-Works, advertised in the JOURNAL on the 18th ult.

A Hitch in the Oil-Gas Experiments at Bradford.—With reference to the appointment of Mr. Lewis T. Wright to superintend an experiment to ascertain the real value of the oil-gas process which has been under trial at the Bradford Gas-Works, some misunderstanding appears to have arisen between him and Dr. Dvorkovitz; and, in consequence, the latter has withdrawn from the test. Last Friday, the Corporation Gas Committee had an interview with Mr. Isaac Smith, who is largely interested in the process; and it was decided to have a fresh trial—Mr. Wright to watch the experiment on behalf of the Corporation, and another gentleman to be selected by Mr. Isaac Smith to safeguard his interests.

Exhibitions of Gas Appliances.—The newly-appointed Manager of the Wakefield Gas Company (Mr. H. Townsend) is working energetically to extend the use of gas in the city. With the support of his Directors, and in conjunction with Messrs. J. Wright and Co., he recently arranged an interesting exhibition of gas lighting and heating appliances, which had a successful run during the four days ending June 28. The exhibition was held in the Corn Exchange; and it was opened by the Deputy-Chairman of the Company (Mr. T. Howden), in the absence through ill-health of Dr. Statter, who has been Chairman of the Company for more than half a century, and who in a few days will attain his 89th year. As mentioned by Mr. Howden in his remarks, one of the chief features of the exhibition was the penny-in-the-slot meter, of which the Company, it was stated, have already nearly 100 in use. Three varieties of the meter have been introduced by them; the makers being Messrs. W. & B. Cowan, Limited, Messrs. J. & J. Braddock, and Messrs. Glover and Co. Messrs. Wright and Co. made a prominent display of their cooking and heating appliances; and the incandescent gas-light was well in evidence. Mrs. J. B. Thwaites, as usual, ably demonstrated the advantages of gas cookers. Messrs. W. Parkinson and Co. held an exhibition from Tuesday to Friday last week at Exeter; Miss E. Sanderson giving a series of practical demonstrations in cookery twice daily.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 86.)

Issue.	Share	Whe ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	22–23	..	4 11 4
100,000	10	,,	7½	Do. 7 p. c.	10	15–16	..	4 13 1
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	104–106*	+1½	4 14 4
200,000	5	10 May	6½	Bombay, Limited	5	6½–7½	..	4 9 8
40,000	5	,,	6½	Do. New	4	5–5¼	..	4 14 7
380,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	250–255	..	4 10 2
180,000	,,	,,	8½	Do. New	100	200–205	..	4 2 11
220,000	Stck.	14 Mar.	11	Brighton & Hove Original	100	220–225	..	4 17 9
888,500	Stck.	28 Feb.	5	Bristol	100	122–125	..	4 0 0
320,000	20	28 Mar.	11½	British	20	53–54	+½	4 3 4
50,000	10	14 Mar.	11½	Bromley, Ordinary 10 p. c.	10	22–23	..	5 0 0
51,510	10	,,	8½	Do. 7 p. c.	10	17–18	..	4 14 5
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	7¾–8	+¼	5 0 0
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	99—102*	+2	5 17 8
150,000	20	28 Feb.	8½	Cagliari, Limited	20	26½–27½	..	6 0 0
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	292–297	+2	4 10 10
165,000	,,	,,	10½	Do. New o.	100	225–230	+8	4 11 4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	142–145	+4	3 2 1
800,000	Stck.	12 June	13	Continental Union, Limited.	100	255–260	..	5 0 0
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	203–208	..	4 16 2
535,000	Stck.	28 Feb.	5½	Crystal Palace Ord. 5 p. c. Stk	100	122–127	..	4 2 8
486,090	10	31 Jan.	11	European, Limited	10	24½–25½	..	4 6 3
354,060	10	,,	11	Do. Partly pa d	7½	17–18	..	4 11 9
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100	285–290	..	4 2 8
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	105–110	..	3 12 9
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	277–282	..	3 10 10
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130–135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	197–202	..	3 14 3
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	190–195	+2	3 11 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	277–282	..	3 10 10
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	165–170	..	3 10 7
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	129–132	+1	3 0 7
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	140–145	..	3 2 1
908,000	,,	,,	6	Do. 6 p. c. do.	100	190–195	+4	3 1 6
3,800,000	Stck.	10 May	12	Imperial Continental	100	247–252	..	4 15 3
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	5½–6¾	..	5 0 0
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p.c. Deb.	100	115–117	+1	4 5 6
541,920	20	12 June	5	Monte Video, Limited	20	15½–16½	..	6 1 2
150,000	5	24 May	8	Oriental, Limited	5	7–7½	..	5 6 8
60,000	5	28 Mar.	7	Ottoman, Limited	5	4½–5¾	..	6 13 4
166,870	10	14 Feb.	2	Para, Limited	10	1½–2½	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	102–106	..	5 13 2
500,000	100	4 June	6	2nd Do.	100	100–105	..	5 14 3
150,000	10	26 Apl.	7	San Paulo, Limited	10	9–10	+½	7 0 0
500,000	Stck.	14 Feb.	15½	South Metropolitan, A Stock	100	355–365	..	4 4 11
1,350,000	,,	,,	12	Do. B do.	100	300–305	+3	3 18 8
290,000	,,	,,	13	Do. C do.	100	307–312	..	4 3 4
775,000	,,	16 Jan.	5	Do. 5 p. c. Deb. Stk.	100	170–175	+2	2 17 2
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	230–235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	290–295*	+5	3 7 10
1,719,514	Stck.	10 Apl.	8	East London, Ordinary	100	235–240	..	3 6 8
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	152–157*	+2	2 17 4
700,000	50	26 June	7	Grand Junction	50	113–117*	..	2 19 10
708,000	Stck.	14 Feb.	12	Kent	100	307–312	..	3 16 11
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	255–260*	+2½	2 17 8
406,200	100	,,	7½	Do. 7½ p. c. max.	100	205–210*	..	3 11 5
330,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	140–143	..	2 15 11
500,000	100	14 Feb.	12½	New River, New Shares	100	375–385	+5	3 6 2
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk.	100	142–144	..	2 15 7
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	157–163	..	2 9 1
126,500	100	,,	4	Do. D 7½ p.c. do.	100	135–140	..	2 17 2
1,155,066	Stck.	12 June	10	West Middlesex	100	285–290*	..	3 9 0

*Ex div.

GWYNNE & BEALE'S
PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM, LONDON." Telephone No. 2698.

GWYNNE & CO.,

HYDRAULIC AND GAS ENGINEERS,

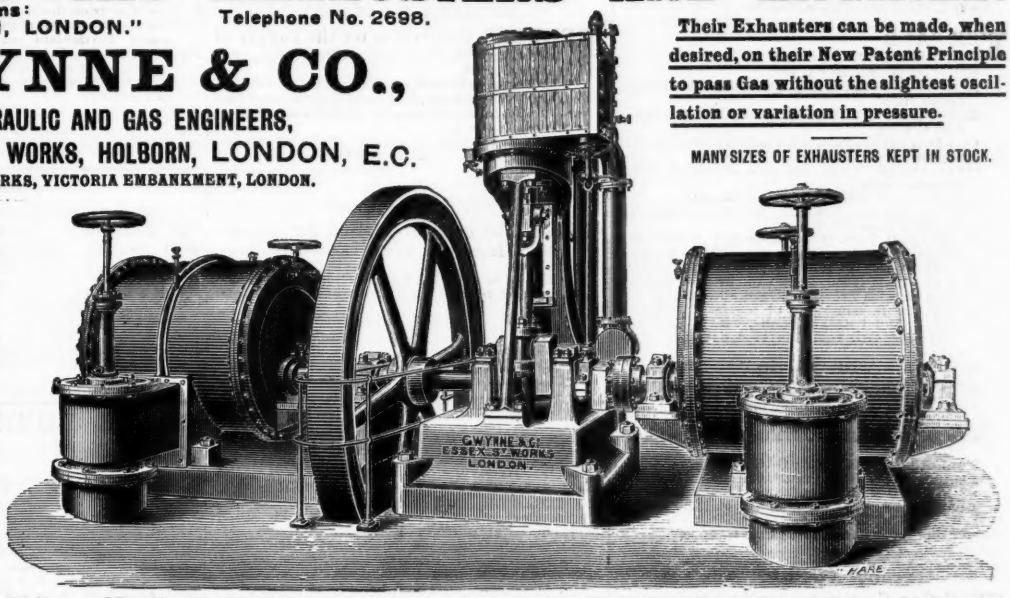
BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

Late ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON.

They have completed Exhausters to the extent of 32,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, PATENT RETORT-LIDS, STEAM-PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.



Their Exhausters can be made, when desired, on their New Patent Principle to pass Gas without the slightest oscillation or variation in pressure.

MANY SIZES OF EXHAUSTERS KEPT IN STOCK.

Exhausting Machinery at Fulham and Bromley Gas-Works, London—each set passing 400,000 cub. ft. per hour drawing 14 miles distant from Beckton.

Catalogues and Testimonials sent on application.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

JOHN WM. O'NEILL, Managing Director, Palmerston Buildings, Old Broad Street, London, E.C.

ANDREW STEPHENSON, AGENT. All communications re Oxide to be addressed to Palmerston Buildings.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 300 British Gas-Works.

ANDREW STEPHENSON,
182, GRESHAM HOUSE,
OLD BROAD STREET,
LONDON, E.C.

Telegrams: "Volcanism, London."

AMMONIACAL LIQUOR Wanted.

BROTHERTON AND CO., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR Wanted.

BROTHERTON AND CO., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE Wanted.

BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

BROTHERTON & CO.

Offices: Commercial Buildings, LEEDS. Correspondence invited.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.

Head Office MIDDLESBROUGH. Correspondence invited.

WANTED, a Situation as Service Layer, METER FIXER, STOVE FIXER, INDEX READER, or for PENNY-IN-THE-SLOT METER WORK. Compo. or Iron. Total Abstainer.

Address A. B., 4, Gilbert Street, Crownfield Road, STRATFORD, E.

SITUATION wanted by a Young Man (aged 33, Married) as PLUMBER or GAS-FITTER in a Gas or Water Works. Understands Gas Meter and Stove Fixing, and Gas and Water Inspection. Good References.

Address No. 2543, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

W. C. HOLMES & CO., Huddersfield; AND 80, CANNON STREET, LONDON, Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also Improved Patent Rotary Scrubber-Washers.

*** See Advertisement p. 66 of this week's issue.

Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO., VICTORIA PAINT WORKS, MANCHESTER.

Telegrams: "ENAMEL." National Telephone 1759.

GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO., VICTORIA PAINT WORKS, MANCHESTER.

For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

AMMONIA SATURATORS.

WALTER THOMASON and SONS, Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.

Please write for Estimate before ordering elsewhere.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E. and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE.

Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

A YOUNG Man (under 23) is wanting a Situation on a Gas-Works where he would practise the detail of the general routine—Carbonizing, Fitting, Main and Service Laying, Repairs to, or erection of, Plant, &c.—in view of qualifying as a Gas Engineer. Is partially acquainted with the whole of the work, but wants more practical knowledge. Is not afraid of dirty work. Can give good References. Could leave present employment at week's notice.

Address (letters, only) No. 2542, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a steady respectable Man as STOKER in a small Works where two are kept. He must be used to Exhauster, and a good Shovel Charger. Constant place to a steady man. Wages, 25s. per week.

Apply, by letter, to No. 2544, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality. Sample and Price on application.

OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.

Telegraphic Address: "PORTER LINCOLN."

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.

READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

THE Undersigned is in a position to supply, at the very lowest Prices, the most suitable kind of BENZOL for enriching Gas, made from Hardman's Patent Carbonization Process, of which I am the Sole Patentee. On application, I would furnish Price on the most reasonable terms; giving advice how to utilize it on the most economical method.

J. HARDMAN, Manufacturing Chemist.
Milton, Staffs.

BACK-PRESSURE IN PURIFIERS.

THE Valve invented by Mr. Cripps for Bye-Passing any Layer of Purifying Material (referred to by the President of the Incorporated Institution of Gas Engineers in his Inaugural Address) can be obtained of the Makers: C. & W. WALKER, Midland Iron-Works, Donnington, near Newport, SALOP, and J. EVERY & SON, Phœnix Iron-Works, LEWES, to which Firms all inquiries should be addressed.

In Paper Covers, Post Free 2s.

STEPHEN CARPENTER, of the Bow Common Gas-Works, on the Purification of Coal Gas by Lime, Oxide of Iron, and Atmospheric Air, and the Method of Working Purifiers so that the Lime may be used a second time, with a description of Carpenter's short Method of working off the Sulphur Test and Table for calculating Results.

S. & H. W. CARPENTER, 3, Bedford Villas, Carshalton, SURREY.

TO GAS-FITTERS.

WANTED, a steady and experienced person as GAS and WATER FITTER, with knowledge of Inside Fittings, able to read Meters, &c.

Apply, stating Age, Experience, and Wages required (not later than July 13), to JOHN DUXBURY, Manager, Windermere District Gas and Water Company.

WANTED, Spent Oxide for prompt delivery, any quantity, containing not less than 50 per cent. Sulphur.
Apply J. HARDMAN, Milton, STAFFS.

FOR SALE—
RETORTS, 190 feet, Oval and Round.
MOUTHPIECES for do., 182.
ASCENSION-PIPES, 168, taper 6 inches to 5 inches, ⅜-inch Metal.
BRIDGE-PIPES, 168, 5 inches by 20 inches wide, with Covers.
Cast-Iron DIP-PIPES, 168, 5 inches diameter, with Flanges.
HYDRAULIC MAIN, 288 feet, 15 inches deep, 18 inches wide.
SECONDARY MAIN, 258 feet of 10-inch.
Patent TAR-RECEIVERS, 18, 9 feet long by 12 inches diameter, flanged.
SCRUBBER TOWERS, 2, 35 ft. by 4 ft. 6 in.—one fitted with Cast-Iron Caps; the other, with Coke.
DONKIN VALVES, 10, 6-inch; 8, 8-inch; 18, 12-inch.
Pair of PURIFIERS, 20 ft. 6 in. by 21 ft. 6 in. by 5 ft. 8 in., with Travelling Gear, all complete.
CONDENSER, consisting of 168 feet of 18-inch Pipe, ⅜ Metal Socket Joints, with Bends, and entering a Cast-Iron Box, 14 ft. 6 in. by 2 ft. by 2 ft. 6 in.
LIVESEY WASHERS, 2, with Piping and Valves complete.
Two LAYCOCK and CLAPHAM WASHERS, with Horizontal Shaft, Fittings, and Valves, all complete.
One DONKIN EXHAUSTER, H.O.M. per hour, with Valves.
Two GAS-GOVERNORS; GAS-BOXES.
Flanged CAST-IRON PIPES, 6, 8, and 12 inch.
SOCKETED MAIN, 8-inch and 12-inch.
BUCK-STAVES, and a quantity of METAL and WROUGHT IRON.
Apply, in first instance, to JOSIAH HARDMAN, Manufacturer, Milton, STAFFS.

BOROUGH OF HEYWOOD.

THE Gas Committee invite Tenders for surplus TAR. Estimated quantity, 600 Tons.
Further Particulars and Form of Tender may be obtained from Mr. Whatmough, Gas Manager.
Tenders, endorsed "Tar," to be sent to me not later than Tuesday, July 16, 1895.
By order,
A. B. PILLING,
Town Clerk.
Municipal Buildings, Heywood,
July 1, 1895.

BOROUGH OF HEYWOOD.

THE Gas Committee invite Tenders for the supply of SULPHURIC ACID and TUBES and FITTINGS.
Specification and Form of Tender may be obtained from Mr. Whatmough, Gas Manager.
Contractors tendering for this work must pay their workpeople at least the standard or trade union rate of wages, and observe the trade conditions which attach to the various kinds of work for which the tender is sent in.
Sealed and endorsed tenders to be sent to me not later than Tuesday, July 16, 1895.
By order,
A. B. PILLING,
Town Clerk.
Municipal Buildings, Heywood,
July 1, 1895.

TAR AND AMMONIACAL LIQUOR.

THE Directors of the Leyland and Farington Gas Company are prepared to receive TENDERS for the surplus TAR and LIQUOR produced at their Works during the next Twelve Months.
Quantity made: About 150 Tons of Tar, and 400 Tons of Liquor.
Delivered free on rails in Contractor's Tanks.
Tenders, endorsed "Tar" and "Liquor," to be in by Monday, the 15th of July, 1895.
CHARLES ELLIOTT,
Secretary.
Leyland, Lancs.,
July 4, 1895.

GAS COAL.

THE Directors of the Leyland and Farington Gas Company are prepared to receive TENDERS for their supply of COAL and CANNEL for the next Twelve Months.
Quantity used: About 1800 Tons of Coal, and 500 Tons of Cannel.
To be delivered free at Leyland Station, in such quantities as required.
Tenders, endorsed "Gas Coal," to be in by Monday, the 15th of July, 1895.
No special form of tender supplied.
CHARLES ELLIOTT,
Secretary.
Leyland, Lancs.,
July 4, 1895.

CORPORATION OF LANCASTER.
(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Gas Committee are prepared to receive TENDERS for the supply of screened GAS COAL, delivered on the Gas-Works Siding, Lancaster, in such quantities and at such times as may be required during a period of One, Two, or Three Years, commencing delivery Sept. 1 next.
Sealed tenders, endorsed "Gas Coal," giving full particulars of the Coal offered, must be delivered to W. O. Roper, Esq., Town Clerk, Lancaster, on or before the 22nd day of July.
Forms of Tender may be obtained on application to the undersigned.
The lowest or any tender not necessarily accepted.
C. ARMITAGE.
Gas-Works, Lancaster,
July 1, 1895.

BOROUGH OF ILKESTON.
(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

TENDERS are invited for the supply of from 1000 to 5500 Tons of GAS COAL for the Year ending July 31, 1896.
Tender Forms to be had on application at the Gas Office, and to be returned, duly endorsed, not later than Noon, July 22, 1895, addressed to Wright Lissett, Esq., Town Clerk, Ilkeston.
The lowest or any tender not necessarily accepted.
F. C. HUMPHRYS,
Engineer and Manager.

TENDERS FOR TAR.

TENDERS are also invited for the sur- plus TAR produced at the Ilkeston Gas-Works for One Year.
The highest or any tender not necessarily accepted.
Forms of Tender and all Information on application to
F. C. HUMPHRYS,
Engineer and Manager.
Gas-Works, Ilkeston,
July 4, 1895.

WREXHAM GASLIGHT COMPANY.

TO TAR DISTILLERS AND OTHERS.

THE Directors of the above Company invite TENDERS for the surplus TAR and AMMONIACAL LIQUOR produced at their Works for One Year commencing on the 1st day of August next. Quantity produced, about 450 and 550 Tons respectively.
Further Information may be obtained on application to the undersigned, to whom tenders must be sent not later than the 20th prox.
The Directors do not bind themselves to accept the highest or any tender.
By order of the Board,
THOS. WALKER,
Secretary and Manager.
Wrexham, June 28, 1895.

NOTICE.

The Incandescent Gas-Light Company, Limited, Hereby Give Notice, that they only supply their Mantles subject to the following express Conditions, which are printed and pasted on each box:—

"The Incandescent Gas-Light Company, Limited, in supplying the Mantle contained in this box, grant a Limited License to the purchaser to sell or use the same on the express condition that neither the purchaser nor any other person into whose hands the same may come shall use or sell the said Mantle except in connection, or for use, with Burners sold or supplied by the Company; any other sale or use will amount to Infringement of the Company's Patents. The Company supply Mantles for the purpose of renewals at the nominal price of 1s. 3d., subject to the Conditions and Limitations above set forth."

In the case of *The Incandescent Gas-Light Company, Limited v. Cantelo*, **Mr. Justice Wills upheld the Validity of these Conditions and Limited License; and, in the course of his Judgment, said:—**

"The patentee has the sole right of using and selling the articles; and he may prevent anybody from dealing with them at all. Inasmuch as he has the right to prevent people from using them or dealing in them at all, he has the right to do the lesser thing—that is to say, to impose his own conditions. It does not matter how unreasonable or how absurd the conditions are. It does not matter what they are if he says at the time when the purchaser proposes to buy, or the person proposes to take a license: 'Mind I only give you this license on this condition;' and the purchaser is free to leave it or take it as he likes. If he takes it, he must be bound by the condition."

In the case of *The Incandescent Gas-Light Company v. Hirschfeld and Others*, **the Honourable Mr. Justice Romer certified that the Validity of the Plaintiffs' Patents was established. Infringers in future will be liable to costs as between Solicitor and Client.**

(Signed) FAITHFULL & OWEN,
Solicitors for the Incandescent Gas-Light Company, Limited.

OSWALDTWISTLE URBAN DISTRICT COUNCIL.

THE Gas Committee invite Tenders for the TAR and LIQUOR produced at their Works for One Year from the 31st day of July, 1895.
The quantity of Coal carbonized is about 3500 Tons.
Further Particulars may be obtained from the Manager, Gas-Works, Church, near Accrington.
Tenders, endorsed "Tender for Tar," to be addressed to me, and to be delivered not later than Wednesday, the 31st of July.
WM. SANDEMAN,
Clerk.
District Council Offices,
Oswaldtwistle, June 26, 1895.

NOTICE.

TO GAS ENGINEERS AND OTHERS.

MESSRS. CLAPHAM BROS., Limited, Keighley, Yorkshire, are no longer authorized to Manufacture my CONDENSER and WASHER-SCRUBBERS.
The above-named Gas Apparatus are erected and giving entire satisfaction at the following places: Neath, Lincoln, Sheffield, Ellesmere, Mountain Ash, Malden, Cullingworth, Montreal (Canada), Woodstock (South Africa), Cape Town (South Africa), &c.
These Appliances can now be obtained solely of the undersigned.
Winchester House, London, E.C. J. A. KELMAN.

GAS PURIFICATION.
Best Absorbent of Sulphuretted Hydrogen, &c.
JAMES E. CAMPBELL,
Patentee and Manufacturer,
96, MILL STREET, BRADFORD, MANCHESTER.
PRICES, &C., ON APPLICATION.

"BEAR CREEK" CANNEL.
LOG MOUNTAIN COAL, COKE, AND TIMBER CO.,
PINEVILLE, KENTUCKY, U.S.A.
Cable Address: "Hull, Pineville."
LONDON AGENTS:
W. J. WILSON & Co., Suffolk House, Cannon St., E.C.

TO EMPLOYERS, COMPANY DIRECTORS, ETC.
The LAW GUARANTEE & TRUST SOCIETY,
LIMITED,
GUARANTEES FIDELITY.
Send for complete Prospectus, containing Balance-Sheet, Copy of Policy, &c., &c.
HEAD OFFICE:
49, CHANCERY LANE, LONDON, W.C.

HOLMSIDE GAS COALS.
PRESENT DAILY PRODUCE OVER 4000 TONS.
LATEST ANALYSIS:—
Yield of Gas Per Ton . . 11,205 Cubic Feet.
Illuminating Power, 16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.
HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.
PRESENT DAILY PRODUCE AVAILABLE, 2500 TONS.
RESULTS OF DIFFERENT ANALYSES:—
Yield of Gas Per Ton . . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13½ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash. . . . . 1·34 Per Cent.
Tar . . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COAL-FIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*
These Coals may be bought through the Principal Merchants in England, or direct from
MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

AUSTRALIAN BOGHEAD.

Practical Results in Ordinary Working:—

Gas per Ton . . . 15,100 Cub. Ft.
Illuminating Power . 45·6 Candles.

For Samples and Prices, f.o.b. London or c.i.f. to Continental Ports, apply to

THOMAS RAISON & Co.,
117, LEADENHALL STREET, E.C.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time, labour, and expense.

For Particulars, Price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 119, Queen's Road, FINSBURY PARK, N.

Prices are Reduced.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.
B Lombard Street,
NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,
MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY
FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

Strongly recommended where EXCESSIVE HEATS have to be maintained.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton .	10,500	Cubic Feet.
Illuminating Power .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Bombay Gas Company, San Paulo Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY, LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON, FITTER.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY, LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

THE DRUM

FOR PUMPING AIR, WATER, SEMI-FLUIDS, &c.

See Advertisement in last and next issue.

LOW MOOR BLACK BED GAS COAL.

YIELD OF GAS PER TON . 10,375 CUBIC FEET.
ILLUMINATING POWER . 17·50 SPERM CANDLES.
COKE . . . . . 75 PER CENT.

Prices, f.o.r. or f.o.b., on application to

GEORGE & JOHN HAIGH,
RAVENS LODGE AND CONYERS' COLLIERIES,
DEWSBURY.

A TRIAL IS RESPECTFULLY SOLICITED.

PIPES, 2-in. to 8-in. PIPES, 2-in. to 8-in. PIPES.

MONIER-WILLIAMS & Co.

IRONFOUNDERS,
MIDDLESBROUGH.

KENT'S THICK GAS COAL

RAISED AT

The Wharncliffe Woodmoor Colliery,
BARNSLEY.

Yield of Gas, nearly 12,000 *Cubic Feet per ton of Coal: and Illuminating Power nearly* 17½ *Candles.*

The following is a complete ANALYSIS made by Mr. R. O. PATERSON, C.E., Gas-Works, Cheltenham:—

Specific Gravity (Water 1). .	1·276
Weight of One Cubic Foot. .	79·700 lbs.

PROXIMATE ANALYSIS.

Moisture in Coal	2·68 per cent.
Volatile Matter.	35·60 ,,
Fixed Carbon	58·80 ,,
Sulphur	0·96 ,,
Ash.	1·96 ,,

COMMERCIAL ANALYSIS.

Gas per Ton of Coal	11,760 cub. feet.
Gas per Cubic Foot of Coal .	418 ,,
Illuminating Power	17·44 candles.
Value of One Cubic Foot in Sperm	418 grains.
Value per Ton of Coal in Sperm	703 lbs.
Coke per Ton of Coal . . .	1367 ,,
Coke	61·05 per cent.
Ash in Coke	3·21 ,,
Sulphur Eliminated with Volatile Products per Ton of Coal	9·4 lbs.
Sulphur in Coke per Ton of Coal	12 ,,
Ammoniacal Liquor per Ton of Coal	19·7 galls.
Tar per Ton of Coal	12·2 ,,

R. O. PATERSON, C.E.

Gas-Works, Cheltenham, 8th August, 1894.

For Price, &c., apply to the

Wharncliffe Woodmoor Colliery Co LIMITED,
BARNSLEY;
Or to Mr. W. H. HARVEY,
17, Old Queen Street, Westminster, S.W.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.

LONDON OFFICE:

90, CANNON STREET, E.C.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co. Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton	10,500 Cub. Ft.
Illuminating Power	16·9 Candles.
Coke (of good quality)	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

TELEGRAPHIC ADDRESS "CANNISTER, LONDON" TELEPHONE No. 4744.

ALFRED WILLIAMS & Co.

71, 72 & 73, BANKSIDE, SOUTHWARK, LONDON S.E.

GAS

Engineers & Contractors.

WATER

RETORT SETTING

MAIN LAYING

PLANS & ESTIMATES ON APPLICATION.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38'22 candles.
Coke per ton	1,301'88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16'3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft
Illuminating Power	16'3 candles.
Coke	73'1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

OR

E. FOSTER & CO.,

21, JOHN STREET, ADELPHI, LONDON, W.C.

JAMES & WILLIAM WOOD, Limited,

GAS COAL AND CANNEL CONTRACTORS AND EXPORTERS,

57, GRACECHURCH ST., LONDON, E.C.

Registered Office—28, ROYAL EXCHANGE SQUARE, GLASGOW.

Wrought-Iron

And Fittings and Accessories.

LAMBERT BROS., WALSALL,

MANUFACTURERS OF

WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM,

BRASS GAS-FITTINGS, GAS-VALVES, STEAM & WATER VALVES, TOOLS, &c., AND OF

WARNER'S PATENT MARKET GAS STAND-PIPE.

LONDON: LAMBETH BRASS & IRON CO., Short Street, LAMBETH.

HUTCHINSON BROTHERS,

GAS ENGINEERS, &c.,

MANUFACTURERS OF

Improved Wet & Dry Gas-Meters.

STATION-METERS. LAMP-METERS.

Test Gasholders and General Gas Apparatus.

Brass Main & Lamp Taps. Unions, Ferrules, &c.

The "Falcon" Lamplighter's Torch. Service Cleansers.

SYPHON AND OTHER PUMPS.

WOOD AND WROUGHT-IRON PURIFIER-GRIDS. SCRUBBER BOARDS.

WET AND DRY METERS REPAIRED.

FALCON WORKS, BARNSLEY.

Telegrams: "HUTCHINSON BROS., BARNSLEY."

HUNTER'S

OXIDE OF IRON.

JAMES HUNTER, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

11, BAY STREET, PORT GLASGOW.

Telegrams: "HUNTER, PORT GLASGOW."

Established 1872.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY,

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

Cloth Bound, Price 3s. 6d., Post Free.

THE ROYAL COMMISSION

ON THE

METROPOLITAN WATER SUPPLY

—1892-3.—

Report of the Evidence (reprinted from the JOURNAL), with comments on the Inquiry, and the Commissioners' Conclusions and Recommendations.

London: WALTER KING, 11, Bolt Court, Fleet St., E.C.

BOWENS' Ltd. Successors,

STOURBRIDGE.

MANUFACTURERS OF

BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.

Established 1860.

PETTIGREW'S PATENT

Sulphate of Ammonia Plant

ON THE CONTINUOUS SYSTEM

Is the newest in the Market, and is the outcome of practical experience in Sulphate Making.

Old Systems easily and cheaply converted.

ANY SIZE ERECTED COMPLETE AT HOME OR ABROAD.

Write for Particulars, Testimonials, and References to

GEO. PETTIGREW & Co.,

GAS AND CHEMICAL ENGINEERS,

MIDDLESBROUGH-ON-TEES.

SELF-SEALING MOUTHPIECES

Made strong for Horizontal and Inclined Retorts in Round, Oval, and ⌂ shapes, and to open at Right Angles for Machine Work. Faced in Ruscoe's Patented Machines; thus ensuring correct and smooth joints when closed.

TESTIMONIALS.

Sheffield United Gaslight Company, Commercial Street, Sheffield, 11th April, 1895.

DEAR SIR,—In reply to your enquiry, I have pleasure in saying that we have a number of your Retort Mouthpieces at work, and that they give perfect satisfaction. Yours faithfully,

FLETCHER W. STEVENSON, Engineer.

Mr. JOHN RUSCOE.

Leigh Urban District Council, Gas & Water Departments, Leigh, Lancs., April 11th, 1895.

DEAR SIR,—In reply to yours of yesterday, I have pleasure in testifying that the Retort Mouthpieces which you supplied to the Leigh Gas-Works seven years ago have given every satisfaction. We have now 267 of the Mouthpieces erected, and hitherto none have required refacing. Yours faithfully,

Mr. J. RUSCOE, Albion Works, Hyde. A. T. FLETCHER.

FOR PARTICULARS APPLY TO **JOHN RUSCOE, ALBION WORKS, HYDE.**

OIL GAS

BETTER TERMS CAN BE OBTAINED FROM SUPPLIERS OF OIL IF PURCHASERS HAVE THEIR OWN

TANK-WAGGONS.

HURST, NELSON, & Co., LTD.,

THE GLASGOW ROLLING STOCK AND PLANT WORKS, MOTHERWELL.

REGISTERED OFFICE:

27, ST. VINCENT PLACE, GLASGOW.

JOHN BROWN & CO., LTD., SHEFFIELD,

Proprietors of

ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

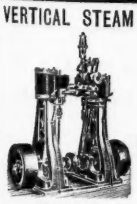
ALDWARKE MAIN GAS COAL

Analysis: 12,600 feet of 19-candle gas per ton.

Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.

Telegrams: "ATLAS SHEFFIELD."

VERTICAL STEAM



ENGINE.

JAMES MILNE & SON, LTD.,

ENGINEERS, BRASSFOUNDERS, & GAS-METER MAKERS,

EDINBURGH: MILTON HOUSE WORKS. | LONDON: 60, HOLBORN VIADUCT. | GLASGOW: 111, ST. VINCENT STREET. | LEEDS: 48, WELLINGTON STREET.

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS,

Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT

MACHINE-MADE GAS-RETORTS.

GAS AND WATER PIPES

AND

CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY,

CHESTERFIELD.

TRADE	TELEGRAMS:	LONDON OFFICE:
CXC	"JACKSON"	12, BURWOOD PLACE,
MARK.	CLAY CROSS.	W.

GODDARD, MASSEY, & WARNER'S

IMPROVED

Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES APPLY TO

GODDARD, MASSEY, & WARNER,

ENGINEERS,

NOTTINGHAM.

The Apparatus has been supplied to the following Firms—

BURT BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (Four Apparatus).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Pye Bridge.

And to the following Gas Companies and Corporations—

ILKESTON.	BURY.	CHORLEY.
WIDNES.	BRIGHOUSE.	WHITEHAVEN.
HALIFAX.	MARKET HARBRO'	CHESTER.
ALTRINCHAM.	PRESCOT.	SOUTH SHIELDS
DENTON.	SOWERBY BRIDGE.	LEEK.
ST. ALBANS.	LEICESTER.	IPSWICH.
DUKINFIELD.	DARWEN.	BOURNEMOUTH.
NORTHWICH.	NELSON.	SALFORD.
HUDDERSFIELD.	ORMSKIRK.	LUTON.
		HAMPTON COURT.

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

MIDLAND DISTRICT OFFICE: 22, TEMPLE ST., BIRMINGHAM—SOLE AGENT: A. C. SCRIVENER.
TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE No. 200.
LONDON DISTRICT OFFICE: 6, STRAND, LONDON—C. PARKER & SON, SOLE AGENTS.
TELEGRAPHIC ADDRESS: "PARKER LONDON."

SOLE AGENTS FOR "HISLOP'S" PATENT REGENERATIVE FURNACES FOR ENGLAND, WALES, AND ABROAD.

— SOLE MAKERS OF —

"MITTON'S" PATENT SELF-SEALING RETORT-LID. — "SETTLE'S" PATENT COMBINED SEAL-REGULATING & FLUSH-VALVE.

JONAS DRAKE and SON

Telegraphic Address: "DRAKESON, HALIFAX." OVENDEN, HALIFAX. Telephone No. 43. HALIFAX EXCHANGE.

London Office: 60, QUEEN VICTORIA STREET, E.C.

GAS ENGINEERS, CONTRACTORS, RETORT SETTERS, IRONFOUNDERS, FURNACE BUILDERS, &c.

ALEX. C. HUMPHREYS, M.Inst.C.E. A. G. GLASGOW, M.E.

MESSRS. HUMPHREYS & GLASGOW

Have during the past 2½ years constructed

CARBURETTED WATER-GAS PLANTS

Of the following daily capacities:—

Copenhagen	700,000 Cub. Ft.	Brussels	700,000 Cub. Ft.
Belfast	1,700,000 ,,	Liverpool	2,500,000 ,,
Glasgow	300,000 ,,	Tottenham	600,000 ,,
Santiago	400,000 ,,		

And have now under Contract:—

Belfast (Second Contract)	3,500,000 Cub. Ft.	Southport	750,000 Cub. Ft.
Brighton	1,250,000 ,,	Manchester	3,000,000 ,,
Swansea	700,000 ,,	Bath	1,000,000 ,,
Preston	1,500,000 ,,		

In addition to which the previous Installations of The Gaslight and Coke Company under this System have a total capacity of 10,000,000 cubic feet per diem.

9, Victoria Street, London, S.W. Telegrams: "EPISTOLARY, LONDON." *United States Office, 64, Broadway, New York.*

TRADE MARK
HOUSE'S CEMENT

USED BY 350 GAS-WORKS.
HOUSE'S
For High Pressures, Cylinder Covers, Steam, Gas, and Water Socket and Flange Manholes.
A Month's free trial.
JOINTING CEMENT
1 cwt. equals 3 cwt. of RED LEAD.
& TANNIC COMPANY, LTD.,

The Ancient Philosophers thought and Cudgelled their Brains with
WHAT IS HOUSE'S TANNIC COMPO. "K.C."?
It will pay you to inquire when you want your Boilers cleaned and you suffer with incrustation.
NO CURE. NO PAY.
A Free Trial to Engineers, Gas Companies, and all Steam Users.
NORTH WORKS, RIPON.

A SCIENTIFIC INVENTION.
ABOUT HOUSE'S BELT
Not made by Rule of Thumb.
Better Power and goes farthest,
Free from Resin.
Cheapest and Best.
Send for Circular and Particulars for Slack Belts.
1 Gallon does the same Work as 56 lbs. of other mixtures.
DRESSING
LONDON AGENTS:
Bale & Co., 120, Newgate Street, E.C.

THE WHESSOE FOUNDRY CO., LTD., DARLINGTON.

Established 1790.

MANUFACTURERS OF EVERY DESCRIPTION OF GAS PLANT,

FROM

RETORTS

TO

GASHOLDERS

FOR WHICH THEY HAVE THE NEWEST AND MOST MODERN MACHINERY.

GASHOLDERS CAN BE MADE OF ANY DIAMETER AND PUT TOGETHER AT THE WORKS.

Holders having a capacity of **8,000,000** Cubic Feet have been made and erected; the largest one being 181 feet diameter by 136 feet 9 inches deep. Riveted entirely with ⅝-inch diameter Hot Rivets.

WE ERECT GASHOLDERS EITHER WITH OR WITHOUT FRAMING.

NO ROYALTIES TO PAY FOR PATENTS.

SOLE MAKERS OF

COATES' IMPROVED PATENT FURNACE DOOR PROTECTOR,

Which has been approved and adopted by the Gas Authorities at

SALFORD, MANCHESTER, BIRKENHEAD, STOCKTON, NEWCASTLE, DARLINGTON, &c.

Telegraphic Addresses: "WHESSOE, DARLINGTON." "WHESSOE, LONDON." | T. COATES, MANAGING DIRECTOR. | WORKS: DARLINGTON. LONDON OFFICE: 28, QUEEN STREET, E.C.

THE

Irish Incandescent Gas-Light Co.,

LIMITED,

HAVING ACQUIRED

The Sole License for the Sale of

INCANDESCENT GAS-LAMPS

(Welsbach System)

In Ireland,

HEREBY GIVE NOTICE THAT

All Communications relative to Lighting must be addressed to

THE MANAGER,

6, GRAFTON STREET, DUBLIN.

CRIPPS' PATENT VALVE FOR BY-PASSING PURIFYING MATERIAL IN PURIFIERS.

The PRESIDENT OF THE INSTITUTION OF GAS ENGINEERS, in his Address, stated—

"To overcome back-pressure, Mr. F. S. Cripps has designed a special form of Valve fixed in conjunction with each layer in Purifiers, and operated from outside the vessel. By this means, any tier can be by-passed as it is fouled, and free access given to the superposed one."

This Valve enables Purifiers to last much longer, without the cost of changing, by permitting the Gas to pass by the Lower Tiers when exhausted, and entering the Upper Tiers only; thus doing away with the heavy Back-Pressure of the Lower Tiers, and fully using up the unexhausted Material in the Upper Tiers.

Will save their Cost in Six Months. **Can be fixed to Purifiers in use, as well as New Purifiers.**

Makers { C. & W. WALKER, Midland Iron-Works, Donnington, nr. Newport, Shropshire.
and J. EVERY & SON, Phœnix Iron-Works, Lewes, Sussex.

To whom all Inquiries should be addressed.

HANNA, DONALD, & WILSON,

(Established 1851),

GAS ENGINEERS & CONTRACTORS,

Abercorn Foundry and Abbey Works,

PAISLEY, N.B.,

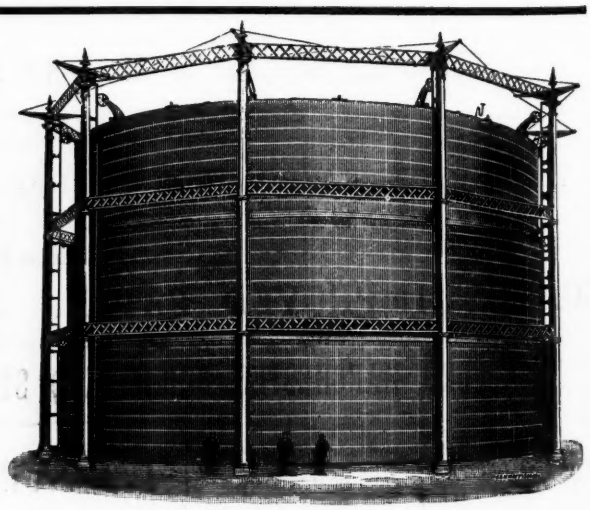
MAKERS OF

Gasholders and Gas Plant

OF EVERY DESCRIPTION.

Sole Agents for Scotland for the Automatic Coal-Gas Retort (Inclined System) Company, Limited.

Telegraphic Address: "Donald Paisley."



IMPROVEMENTS IN STREET LIGHTING.
HIGHEST EFFICIENCY WITH GREATEST ECONOMY.

LIGHTING AUTHORITIES, GAS ENGINEERS, & GAS MANAGERS

Are invited to inspect the

INCANDESCENT GAS-LIGHT

Which has now been successfully adapted to the purposes of

STREET LIGHTING,

THE DIFFICULTIES CAUSED BY VIBRATION HAVING BEEN OVERCOME BY THE USE OF A SPECIAL BURNER, WHICH GIVES HIGHLY SATISFACTORY RESULTS.

Two forms of Burners are specially recommended for Street Lighting.

The "C" BURNER,

Giving a Light of 60 Candles, with a Consumption of 3½ Cubic Feet of Gas an Hour.

The "S" BURNER,

Giving a Light of 25 to 30 Candles, with a Consumption of 2¼ Feet of Gas an Hour.

This System of Lighting meets the Requirements of all the Lighting Authorities in those Districts where it is desired to effect an Improvement in Street Lighting, without any increase of expenditure.

THE INCANDESCENT GAS-LIGHT has been tried with most satisfactory results for Street Lighting purposes in many Towns throughout the United Kingdom.

The Lighting Engineer of the Kensington Vestry, in a report dated the 14th of May, 1895, addressed the Works and Sanitary Committee as follows:—

(1) During the months of January, February, and March, 1895, 31 Incandescent Gas-Lamps were in use for an average period of 1167·89 hours.

The estimated quantity of gas that would have been consumed by the 10-feet flat-flame burner was 11,678 cubic feet. The actual quantity of gas used by the Incandescent Gas-Light Company's Burners, as recorded by the meters, was 4415 cubic feet.

After allowing for the extra cost of up-keep, the gain to the Vestry by the use of these burners was £20 3s. 4¾d., and a large increase in the Illumination of the Street.

(2) The illuminating power given by the Incandescent Gas-Burners, consuming 3·78 cubic feet of gas per hour, was found to be equal to 60 candles. That given by the flat-flame burners, consuming 10 cubic feet of gas per hour, was 26 candles.

The lanterns fitted with Incandescent Burners only require cleaning 9 times in 90 days, as compared with 26 times' cleaning in the same period required by the lanterns fitted with flat-flame burners.

The net result therefore appears to be that, by the use of the Incandescent Gas-Light System, the saving effected is over 50s. per annum per lamp, and at the same time more than double the light is obtained.

It must be noted, however, that these results were obtained with the ordinary burners, and not with the improved burners with the anti-vibration springs. With the latter, the expense of up-keep would be materially reduced, and the saving consequently increased.

For further Particulars, apply to

THE INCANDESCENT GAS-LIGHT COMPANY, LTD.,

PALMER STREET, WESTMINSTER, LONDON, S.W.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, LTD.

During the past Two Years have installed their

PATENT CARBURETTED WATER-GAS APPARATUS

At TORONTO, One Set. BELLEVILLE, One Set. OTTAWA, One Set.
KINGSTON, One Set. MONTREAL, One Set.
And have remodelled at LINDSAY, One Set; BRANTFORD, One Set.

Second Contracts.

TORONTO, Four Sets remodelled; originally of the type now being erected in Great Britain.
OTTAWA, One Additional Set. MONTREAL, One Additional Set.

Now Constructing.

BLACKBURN, Two Sets; COLCHESTER, One Set; and remodelling PETERBOROUGH (Canada) Works.

In addition to which the previous Installations of The Gaslight and Coke Company were carried out by THE UNITED GAS IMPROVEMENT COMPANY OF AMERICA, of which Messrs. MERRIFIELD AND WESTCOTT were late Engineers.

London Offices: SUFFOLK HOUSE, LAURENCE POUNTNEY HILL, E.C.

CLAYTON SON & Co LTD

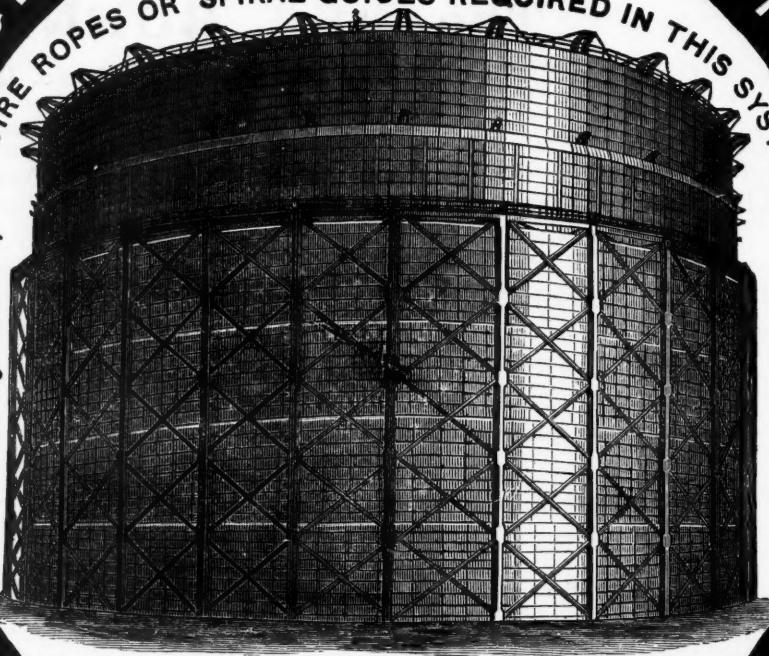
MAKERS OF

WORKS LEEDS

THE LARGEST GASHOLDER IN THE WORLD.

GASHOLDERS OUR SPECIALITY

NO WIRE ROPES OR SPIRAL GUIDES REQUIRED IN THIS SYSTEM.



INFINITELY SAFER AND FAR LESS COSTLY THAN ROPES OR SPIRAL GUIDES.

CAPACITY 12 MILLION CUBIC FT.

ERECTED AT EAST GREENWICH FOR THE South Metropolitan Gas Company
IT HAS SIX LIFTS 30 FT DEEP EACH AND IS 300 FT DIAR

MAKERS OF GAS PLANT OF EVERY DESCRIPTION

ROOFS PURIFIERS &c. ALSO

ADDRESS LONDON 60, QUEEN VICTORIA ST.
TELEGRAPHIC "GAS, LEEDS."

GASHOLDERS OF ANY SIZE

ERECTED & COMPLETED WITHIN 12 MONTHS AND AT THE TIME SPECIFIED

STOURBRIDGE
RETORTS AND FIRE-BRICKS.
BEST QUALITY.
KING BROTHERS, STOURBRIDGE.
[See Illustrated Advertisement, July 2, p. 5.]

HARPER & MOORES,
STOURBRIDGE.
MANUFACTURERS OF
BEST FIRE-BRICKS, GAS-RETORTS,
LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.
Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.
MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.
ESTABLISHED 1836.

OSLER,
BIRMINGHAM.
MANUFACTURERS
OF GASELIERS
IN GLASS AND METAL.

WILSON CARTER & PEARSON,
GAS COAL AND CANNEL FACTORS,
Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.
ADDRESS CHIEF OFFICES:
Temple Buildings, 50, New Street, Birmingham.

ESTABLISHED 1861.
JOHN BROTHERTON, LIMITED,
IMPERIAL TUBE WORKS,
WOLVERHAMPTON,
MAKERS OF
TUBES AND FITTINGS
FOR EVERY PURPOSE.
PLEASE APPLY FOR LISTS. Telegrams: "IMPERIAL, WOLVERHAMPTON."

The Climax of Regenerative Gas Lighting!!
THE
"VERTMARCHE"
A 280-CANDLE POWER
PLAIN IRON LAMP,
CLASS A— 55/-
LIGHT for LIGHT
less than half the price of any other Regenerative Lamp.
Manufactured in England.

HENRY GREENE & SONS,
153 & 155, CANNON STREET,
LONDON BRIDGE, E.C.
PARTICULARS AND PRICES FREE. AGENTS WANTED.

ARROL-FOULIS
Patent Automatic Machinery
FOR
DRAWING AND CHARGING
GAS-RETORTS.
Full Particulars may be obtained from the Sole Makers,
SIR WILLIAM ARROL & CO., Limited,
GLASGOW.
See Illustrated Advertisement, p. III. Centre of JOURNAL for July 2.

BEST & LLOYD
MAKERS OF THE BIRMINGHAM.

PATENT "SURPRISE"
PENDANT,
WITH PATENT SHADE.
The ONLY GAS-PENDANT suitable for Domestic Lighting; a room 18 ft. by 14 ft. being beautifully illuminated with one Incandescent Burner.
Extract from the JOURNAL OF GAS LIGHTING, Jan. 8, 1895.
"IN CONJUNCTION WITH
THE INCANDESCENT GAS-LIGHT,
it quite **supersedes** the familiar three-light pendant. We are able to bear witness to the **convenience** of the New Pendant."

JOSEPH CLIFF & SONS,
INCORPORATED IN
THE LEEDS FIRE-CLAY COMPANY, Ltd.,
WORTLEY, LEEDS.
LONDON OFFICES & DEPÔTS:
Baltic Wharf, Waterloo Bridge.
WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.
LIVERPOOL:
16, Lightbody Street.
LEEDS:
Queen Street.
MACHINE-MADE RETORTS
Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.
RETORTS CAREFULLY PACKED FOR EXPORT.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

ESTABLISHED 1825.

GAS TUBES

MANUFACTURERS OF EVERY DESCRIPTION OF

IRON OR STEEL LAP-WELDED OR BUTT-WELDED TUBES

FOR ANY PURPOSE.

MOBBERLEY & PERRY

STOURBRIDGE.

Manufacture & supply best quality of

Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)

Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.

FIRE BRICKS, LUMPS, & TILES, BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c. &c.

EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.

Contractors for the erection of Retort-Benches complete.

London Agents:

BALE & HARDY, Gas Engineers and Contractors, BRIDGE HOUSE, 181, QUEEN VICTORIA STREET, E.C.

CLAPHAM BROTHERS, LIMITED,

— ESTABLISHED 1837 —

LARGE REPEAT ORDERS

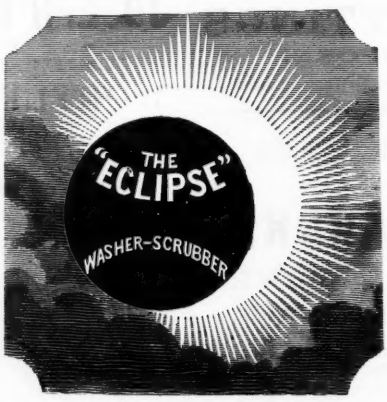
Have been received for

Laycock & Clapham's Patent

"ECLIPSE"

WASHER-SCRUBBERS.

Order Early.



GREAT SUCCESS

OF

Clapham's Patent

"ECLIPSE"

CONDENSER.

SEND FOR PARTICULARS.

CLAPHAM'S IMPROVED VALVES, PURIFIERS, AND RETORT-FITTINGS, MAINS, AND GENERAL CAST AND WROUGHT IRONWORK.

Catalogues, New Book of Testimonials, and full Particulars on Application.

Wellington, Nelson, and Market Street Works, KEIGHLEY, YORKS.

LONDON: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, July 9, 1895.